

# What causes hot markets for equity IPOs? An analysis of initial public offerings in the Netherlands, 1876–2015

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This paper explains fluctuations in the number of initial public offerings (IPOs) between 1876 and 2015 in the Netherlands. We test an econometric model and find that the number of IPOs is strongly related to the economic growth and the size of the stock exchange. We also find that IPOs are timed to coincide with favorable market conditions. Our model explains almost 50 percent of the fluctuations and most of the hot markets. To further understand IPO waves, we conduct a descriptive analysis, which yields two additional causes for hot markets, i.e., high capital needs and investors' expectations for specific industries.

## 1. Introduction

In economic history, the role and development of public capital markets is an important topic (Michie 2006). These public markets are crucial for funding firm investment and growth, in addition to private capital that is provided, among others, by banks (Levine and Zervos 1998). At the same time, public capital markets are accessible to all investors, from small retail investors to large institutions (Merton and Bodie 1995). Public capital markets grow when firms decide to go public. For a country's financial system, a vibrant market for public equities is important to facilitate efficient allocation of capital and opt out options for entrepreneurs. To make an initial public offering (IPO) is an important decision for firms and is considered to be a driving force for a firm's development by getting access to public capital markets. An interesting phenomenon is a hot IPO market, which arises because IPOs cluster in time (Lowry 2003). In this paper, we aim to understand the growth of public capital markets through the occurrence of IPOs in hot markets.

Recently, several economic and financial historians have investigated IPOs in specific institutional settings and eras. In particular, the UK market has been thoroughly investigated. The seminal paper by Chambers and Dimson (2009) has documented the UK IPO market in most of the twentieth century and measures underpricing as a metric for market efficiency. The authors show that over the century, underpricing has increased, from 3.8 percent in 1917–1945 to 9.2 percent in 1946–1986. Chambers (2009) further investigates the post-1945 IPO market and demonstrates several market failures, which explain the increased underpricing. In further contributions to the understanding of the UK IPO market, Chambers studies the effects of self-regulation by the London Stock Exchange (Chambers 2010; Burhop *et al.* 2014). In a series of three studies for the London Stock Exchange, Fjesme *et al.* (2019, 2021,

forthcoming) study an earlier period, starting in the late nineteenth century. They find that the exchange plays a vital role in funding old and new firms and industries (Fjesme *et al.* 2019), that the exchange was effective in screening firms that were admitted or rejected (Fjesme *et al.* 2021), and that the networks of directors contribute to better IPO outcomes (Fjesme *et al.*, forthcoming).

The result for the UK that early public markets were remarkably efficient is confirmed in studies for the German market. Burhop (2011) finds for the Berlin Stock Exchange between 1870 and 1896 average underpricing to be less than 5 percent. Fohlin (2010) confirms that investors in Germany's new stock issues in the 1880s experienced low spreads. Also, Lehmann and Streb (2016) show that innovative firms in the period 1892–1913 could rely on the Berlin stock market as a financing source and that they faced low underpricing. Lehmann (2014) attributes the efficiency of the early market to competition among a small group of banks and tight underwriting regulation, keeping fees low. Burhop and Lehmann-Hasemeyer (2016) document for 1913 the importance of regional markets, in addition to the Berlin Stock Exchange, for smaller companies. It is interesting that few studies exist for the early US market. An exception is Wright (2002), who studies the period 1781–1861 and again shows that unregulated IPO markets can function efficiently. In the finance literature, US IPOs have been studied over relatively short and recent periods of time (see Ibbotson and Jaffe 1975; Ritter and Welch 2002; Lowry 2003). We are aware of one paper in Italy, where Cattaneo *et al.* (2015) study all 879 Italian IPOs from the unification of Italy in 1861 until 2011 and conclude that tighter regulation improves IPO survival rates.

The literature on the history of IPOs reveals that in the nineteenth century, highly efficient markets for new equity already existed in Western Europe and the USA. While the existing studies demonstrate that IPOs have played an important role in funding companies and were an efficient instrument to attract capital, little is known about the determinants of fluctuations over time in IPOs. In this paper, we study IPOs in the Netherlands over a long period of 140 years. IPOs on the Amsterdam Stock Exchange in 1876–2015 were highly clustered and fluctuated widely from 49 offerings in the years 1917 and 1920, to years without any issues such as 1976 and 1977. We aim to understand fluctuations in the number of IPOs and in particular the clustering of IPOs in hot markets. We define a hot market as a year in which the 3 year moving average of the number of IPOs is in the highest quartile of the data set (following Helwege and Liang 2004).

We explain the yearly fluctuations in the number of IPOs by using two complementary analyses. We first use econometric modeling and estimate a time series regression to determine whether the fluctuations in the number of IPOs can be explained by time-varying economic and market variables that are considered to be drivers of the number of IPOs and clustering in time according to the literature. Obviously, this model can only predict a part of the time series variation in the number of IPOs. We thus use the model to predict the number of IPOs and then compare predictions with the actual number of issues. As a result, we can define not only hot periods that were predicted by the fundamentals in our model but also hot periods that were not predicted by the model. We conduct an in-depth descriptive analysis to explain the hot markets that cannot be explained by our econometric model.

We find evidence with our time series model that economic growth is a strong driver of IPOs, consistent with previous studies using recent data (Lowry 2003; Pastor and Veronesi 2005). Next, we find that the number of IPOs depends on time-varying market conditions. Throughout the whole period, the number of IPOs is strongly positively related to stock market past returns and negatively associated with the volatility in stock market returns, which indicates uncertainty. We find no support that IPOs are timed based on a temporary

overvaluation, indicated by a high stock market level. Finally, we find evidence that the size of the stock exchange positively affects the number of IPOs. The model can explain about 50 percent of the variation in the number of IPOs.

We observe eight hot markets, where the number of IPOs (3 year moving average) is in the upper quartile of the distribution. Five of these hot markets can be explained by our time series model, mainly because these are years with high gross domestic product (GDP) growth and increasing stock prices. With further descriptive analyses, we try to understand the other three hot markets that our model fails to explain. The main reason for this is that our model assumes that the fluctuations are driven by general economic and market conditions that affect all industries in the same way. Jain and Kini (2006) argue that this is not the case: hot markets can be dominated by a specific industry. Another reason is that our model does not consider the effect of institutional changes. To overcome these limitations, we infer additional causes of hot markets from detailed contextual descriptions. We find evidence that industry-specific aspects and institutional shifts are essential drivers of hot markets. The increasing role of firms active in the Dutch East Indies in the Dutch and global economies at the end of the nineteenth and the beginning of the twentieth centuries led to several years with hot IPO markets. Also, the 3rd industrial revolution in the 4th quarter of the twentieth century led to a hot IPO market. The preference of investors for information technology-based firms in combination with lower entry requirements for a listing also triggered years with hot markets.

Our contribution to the economic and financial history literature on IPOs is that we focus on the determinants of IPOs, rather than the pricing and the role in the funding of firms. We show that general economic factors such as growth and financial market conditions, as well as industry-specific capital needs, explain the number of IPOs over time. Our work contributes to a previous work that primarily focused on the efficiency of the IPO market by addressing the question of why firms decide to go public. In further research, we hope that research will continue on this path by comparing IPO firms with private firms to explain IPO determinants at the firm level. We also hope that subsequent research will apply our methods in other settings in order to facilitate comparative studies.

The remainder of this paper is organized as follows. In the next section, we give an overview of the literature on the fluctuation and clustering of stock IPOs and the evolution of relevant institutions in the Netherlands. In Section 3, we describe our sources and variables, while Section 4 presents the methods. In Section 5, we describe our data, and our time series regression model is presented in the Section 6. In Section 7, we investigate via an in-depth historical analysis the hot IPO markets, and conclusions are offered in Section 8.

## 2. Background

### 2.1. Going public

Firms use long-term capital to finance investment opportunities and future growth. Because there are more opportunities in an upswing of the business cycle, the demand for long-term capital is higher than in a contraction phase. As a consequence, the IPO volume and the number of IPOs vary with the business cycle. Using recent US data, Lowry (2003) finds that changes in firms' demand for capital explain a substantial portion of the variation in IPO volume. It should be noted that historical research has found that stock market funding is not a necessary condition for economic growth (Jansson 2018). Clustering of IPOs also occurs when firms time equity issues based on favorable market conditions in order to receive the

highest proceeds (Baker and Wurgler 2002). The market value of stock increases when stock prices rise, and the market value of bonds increases when interest rates drop. Pastor and Veronesi (2005) present and empirically test a model in which the number of IPOs fluctuates by time variation in market conditions. They find, again for a sample of recent US IPOs, that the number of IPOs is related to the business cycle via time variation in expected aggregate profitability and that IPO waves are preceded by high market returns since the cash flow expectations of investors go up. In addition, they find that negative market conditions for equity issues are also determinative, so that in periods with high market uncertainty, investors are reluctant to participate in IPOs.

A hot IPO market is characterized in the literature by an unusually high volume of offerings, severe underpricing, frequent oversubscription, and a high participation of retail investors, in a specific period. According to Helwege and Liang (2004), there is not much difference between the dominant industries in hot and normal markets, indicating that hot markets are driven by overall market conditions. Other authors have noted that firms tend to go public in waves, with many firms in the same industry going public around the same time. According to Pagano *et al.* (1998), Italian firms at the end of the twentieth century issued an IPO in times when the market-to-book ratio of listed firms of the same industry is high, and Lowry (2003) states, based on late twentieth century US data that the positive sentiment among investors for certain IPOs is more valuable for firms in the same industry, that hot markets may be dominated by a specific industry. In addition, technological developments normally do not arrive at a constant pace and are not distributed equally over all industries, which could also be a cause that hot markets may be dominated by a specific industry (Pastor and Veronesi 2005).

## 2.2. The Dutch economy

Since the end of the nineteenth century, the Dutch economy went through three phases (Smits *et al.* 1999). The first phase is the so-called 1st industrial revolution. Being a country of traders, the opening of the Suez Canal in 1869 was of great importance as it reduced the journey by sailboat between the Dutch East Indies and the Netherlands. With the opening of the *Nieuwe Waterweg* in 1872 and the *Noordzeekanaal* in 1876, canals that connect the harbors of Rotterdam and Amsterdam with the North Sea, respectively, large ships from all over the world could now enter these harbors. The port of Rotterdam became a hub for the transit of goods toward Germany, the UK, and the USA. Many of these goods came from the Dutch East Indies. With the gradual abolishment of the so-called *Cultuurstelsel* in 1870, the monopoly of the Dutch government to invest in and trade with the Dutch East Indies was lifted. This attracted many Dutch entrepreneurs to start a firm, and from the end of the nineteenth century, the number of firms active in the Dutch East Indies grew spectacularly.

In 1913, the 2nd industrial revolution started with the widespread use of electricity. The role of the Dutch East Indies in the economy was still increasing but temporarily interrupted by the First World War. However, being neutral during this war turned out to be very profitable. When the war had ended, the production capacity was still in place, and since this was not the case in the surrounding countries, growth opportunities were high in a booming economy. Like in the First World War, the Dutch government tried to stay neutral during the Second World War. However, in May 1940, Germany invaded the Netherlands, and this occupation lasted until May 1945. The Second World War had a devastating effect on the Dutch economy, and GDP decreased in this period with more than 50 percent; much of the infrastructure was destroyed. After the war and the independence of Indonesia, the government developed a plan

to change the structure of the industries from an agriculture-orientated into an industrial-orientated economy (Van Zanden 1997). This triggered an era of modernization. The 3rd phase of the industrial revolution started in the Netherlands in the 1980s when Information and Communications Technology (ICT) became a dominant technology and most Dutch firms are in the commercial services sector (Sluyterman 2003).

### 2.3. *The Dutch capital market and the Amsterdam Stock Exchange*

In May 1876, a new era started for the Amsterdam Stock Exchange with the establishment of the *Vereeniging voor den Effectenhandel*. Its goal was to create a stock market that was only accessible for members in order to bring structure and regularity into trading and to better look after the interest of investors (De Vries 1976). Until then, the stock market at the *Groote Koopmansbeurs* was sometimes chaotic as a result of the unlimited access of public and traders. The prices for which securities were traded was often unclear, which frequently gave suspicions of fraud. At the start in 1876, the *Vereeniging* had 286 members, and in the 1st year, the total number of members already grew to 465 (De Vries 1976). The *Vereeniging* drew up rules for trade and published daily prices, and in 1903, listing requirements and a vetting process were formalized (De Jong and Röell 2006). In 1876, the main listings on the Amsterdam Stock Exchange were from foreign government bonds and stocks and bonds of Dutch and foreign railway companies and banks.

The stock exchange was built on self-regulation, as from the end of the nineteenth century, the Dutch government had a laissez-faire approach for the economy. The government regarded it best to abstain from intervening and let market forces work freely. Exchange-listed firms were *naamloze vennootschappen*, i.e., corporations, and the only limitation was that a Royal approval was needed to start a limited liability firm (Westerhuis and De Jong 2015). To have its shares listed, the issuing firm needed the services of one of the members of the *Vereeniging voor den Effectenhandel* (De Vries 1976, p. 147). The application for the listing needed to be filed by one of these members within 24 hours after a notice was published in a national paper, stating that subscriptions for the shares will be accepted and that a request for a listing of the shares would be submitted. Together with the application, the member had to hand over several documents, including the prospectus of the issue and the firm's articles of association, balance sheet, income statement, and the latest annual report. In order to have a price published in the *Officieele Prijscourant* (the official price current), the volume of the issue needed to be at least 500,000 guilders and 25 percent of the placed capital. The exchange did not impose minimum size criteria.

Between 1890 and 1918, the banking system in the Netherlands expanded rapidly (Jonker 1996). When the *prolongatiemarkt* (on-call market) became obsolete in the late 1920s, more deposits flowed to commercial banks and these banks began to develop industrial finance, coupled with accelerating their move into branch banking (Jonker 1996). Dutch banks were underwriters of new issues, usually in a consortium in which one of the participating banks takes on the role of lead underwriter. In the late nineteenth and early twentieth centuries, this consortium usually bought the shares from the issuing firm, offered these shares to investors, and listed the shares on the stock exchange. Later on, this consortium only acted as a conduit (De Jong and Röell 2006). It should be noted that in the Netherlands, there were no restrictions on combining commercial and investment banking, unlike the Glass-Steagall Act of 1933 in the USA. By 1913, the Netherlands had one of the largest stock markets, when compared with GDP, in the world. Rajan and Zingales (2003) find a ratio of stock market capitalization to GDP of 0.56, which is higher than the USA (0.39) and Germany

(0.44) but below the UK (1.09) and Belgium (0.99). The banking sector was relatively small with deposits/GDP at 0.22, while the USA has 0.33; Germany, 0.53; the UK, 0.10; and Belgium, 0.68.

The liberal vision of the government changed when the government regulated the stock exchange with the Stock Exchange Law in 1914.<sup>1</sup> The influence of the government increased even more during the Great Depression, and since then, the Dutch economy can be considered a coordinated market economy in which the government played an important role (Sluyterman 2003). The Royal approval that limited liability firms needed was replaced in 1928 by a statement of no objection by the Minister of Justice. With a law reform in 1928, the rules on disclosure of information also changed. The legal position of investors was strengthened and the liabilities of the management of the issuing firm and its underwriter were enlarged in case of omissions in the prospectus (Van Lutterveld 1933). In the meantime, with a sharp downturn in the economy in the early 1920s, many banks ran into severe difficulties and withdrew themselves from industrial financing (Sluyterman 2003; Colvin *et al.* 2015).

Between 1876 and the early 1930s, the number of listed securities increased dramatically, for which the obsolescence of the *prolongatiemarkt*, the most important system within the Dutch credit system in the beginning of the twentieth century, gave an extra impulse. Since that period, the listings on the Amsterdam Stock Exchange reflect the most important sectors of the Dutch economy. The number of listed firms active in the Dutch East Indies grew every year. Rajan and Zingales (2003) report for the Netherlands in 1938 a market capitalization to GDP ratio of 0.74.

After the Second World War, the stock exchange was an important source of funding.<sup>2</sup> The Amsterdam Stock Exchange expanded between 1953 and 1976 and globalized between 1976 and 1985 (De Vries 1976). From the commercial code introduced in 1838 onwards, the dominant vehicle for companies had been the *naamloze vennootschap* because this was the only corporate form to offer limited liability. However, in 1971, a new company form was introduced: the private limited liability company (*besloten vennootschap*), for which no special approval was needed. Due to this, many firms changed into private companies and newly founded companies chose in most cases not for a limited liability form. In the meantime, the listing requirements for the Amsterdam Stock Exchange are similar to other exchanges: a minimum float of at least 25 percent, a value of shareholders' equity in excess of 10 million guilders, and a track record of at least 5 years (De Jong *et al.* 2014).

From the 1960s onwards, banks had become larger due to mergers, which was considered to be a risk by the central bank, *De Nederlandse Bank* (DNB). To mitigate this risk, guidelines used by DNB were converted into legislation in 1978. In 1990, legislation on banks was eased when Dutch legislation was aligned with EU guidelines. As a consequence, the main banks merged into three dominant banks (ABN-Amro, ING Bank, and Rabobank) and became global banks.

<sup>1</sup> The state of emergency that arose as a result of the First World War, led to the Stock Exchange Law of 1914. With this law, the stock exchange was placed under the supervision of the Minister of Finance. Although this law initially had a temporary character, it turned out to be of very long duration in practice.

<sup>2</sup> Due to the general panic caused by the German invasion of the Netherlands, the stock exchange in Amsterdam was closed from 10 May, 1940, until 15 July, 1940, and active trading was limited from 8 December, 1941, until 16 December, 1941, when the war broke out in the Far East. On 5 September, 1944, trade came to a halt due to war activities in the south of the Netherlands and it took until 7 January, 1946, before any trade could take place again. Only on 1 April, 1947, all limitations on trading were lifted (De Vries 1976).

In the final quarter of the twentieth century, the stock market seems to lose its importance for the Dutch economy. Rajan and Zingales (2003) observe a market capitalization to GDP ratio of only 0.19 in 1980 and the number of listings decreases. However, the listed firms in the latter part of the twentieth century are much larger and include some of the world's largest multinationals, such as Royal Dutch-Shell, Unilever, and Philips. After a surge in stock prices the market capitalization to GDP ratio is 2.03 in 1999. In addition to the large firms, the exchange is also aiming to attract smaller new firms: on 28 January, 1982, the Official Parallel Market started with eleven listed firms and because this 2nd-tier market had lower entry requirements the number of listings grew in the next years mainly with small firms.<sup>3</sup> The intention was that these firms would grow and subsequently be included in the official listing. However, not much came of that. As of 1 October, 1994, no new firms were admitted and the majority of the firms that were already listed were transferred to the official listing.<sup>4</sup> At that time, Amsterdam Exchanges was the 5th largest stock exchange in Europe and the 9th largest in the world.<sup>5</sup> On 24 March, 1997, the 1st firm got listed on the *Nieuwe Markt Amsterdam Exchanges* (NMAX), which was a new market for smaller firms.<sup>6</sup> In 2000, Amsterdam Exchanges merged with the stock exchanges of Brussels and Paris into EuroNext, and in 2007, EuroNext merged with the New York Stock Exchange.<sup>7</sup>

### 3. Data

In this section, the main sources of the data are described, as well as our variables. We define a year with a hot market as a year in which the 3 year moving average of the number of IPOs is in the highest quartile of the data set, following Helwege and Liang (2004).<sup>8</sup>

The time series for the number of stock IPOs per year is constructed as follows. The number of IPOs from 1903 to 2005 is based on the *Gids bij de Officiële Prijscourant*. For the IPOs for which the issue date is unknown, the year of the IPO is assumed to be the 1st year that a firm is mentioned in this yearly publication. To determine which firms were introduced from 1876 until 1903, the listings published in the *Nieuw Algemeen Effectenblad* or *Officiële Prijscourant* at the end of December of a year is compared with the listings published at the end of December in the previous year. The same is done to determine the number of IPOs for the years 1946–1949 because the *Gids bij de Officiële Prijscourant* was not published. For 1945, no data are available. The data for 2006–2015 are taken from the database *Review and Analysis of Companies in Holland* and EuroNext. IPOs on the Official Parallel Market (between 1982 and 1994) and on the NMAX (between 1997 and 2004) are based on data provided by EuroNext.<sup>9</sup> IPO dates are from the *Gids bij de Officiële Prijscourant*, *Nieuw Algemeen Effectenblad*, *Officiële*

<sup>3</sup> Officiële Prijscourant 28 January, 1982.

<sup>4</sup> "Bijna alle fondsen van Parallelmarkt naar grote beurs", *Trouw*, 29 September, 1994.

<sup>5</sup> Annual Report Amsterdam Exchanges, 1997.

<sup>6</sup> Officiële Prijscourant 24 March, 1997. The NMAX merged with Euro.NM, the European platform for young dynamic firms, in October 1997. At the end of 1998, Euro.NM contained the NMAX in Amsterdam, Le Nouveau Marché in Paris, Die Neuer Markt in Frankfurt and Euro.NM Belgium in Brussels. Listings on the NMAX ended in 2004, and in November 2006, another tier for smaller firms was established: Alternext Amsterdam. This platform was also unsuccessful in the Netherlands and ended in 2014.

<sup>7</sup> Annual Report Amsterdam Exchanges, 1998.

<sup>8</sup> Interestingly, there is no equivalent of a hot market for years with low numbers of IPOs. The notion of such a "cold" market is problematic because the number of IPOs cannot be negative. This implies that outliers can only be found on the upside. We thank an anonymous referee for pointing this out.

<sup>9</sup> Our time series contains fifty-eight IPOs that were listed on the Official Parallel Market and sixteen on the NMAX.

*Prijscourant*, and EuroNext. Each IPO from a Dutch firm is classified in an industry and sector according to the *Standaard Bedrijfsindeling* (Centraal Bureau voor de Statistiek 2008).

In our study, IPOs of financial firms (banks, insurance companies, real estate firms, and investment funds) are excluded because in our economic model, we focus on explanatory variables that relate to nonfinancial firms. For example, the GDP growth relates much more to activities in industrial, trade, and service activities than financial intermediation. Also, financial variables such as stock returns and interest rates affect the funding of nonfinancials in a straightforward way, which does not apply to, for example, banks and investment funds. Although we omit financial firms, it would be very interesting to conduct a similar analysis for financial firms.

We expect that fluctuations in number of stock IPOs are positively related to fluctuations in the business cycle, which is proxied by GDP growth. The time series for this is based on data from CBS.<sup>10</sup> Since debt is an alternative for a stock issue, we expect a positive relation between the fluctuation in the number of stock IPOs and the long-term interest rate. Next to the long-term interest rate, we add the yield curve, or interest rate structure, as a variable. The yield curve is the spread between the interest rates on bonds with 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, a rolling investment in short-term bonds is a perfect substitute for a single investment in a long-term bond, for the same period. According to this theory, the yield curve represents investors' expectations of future interest rates and is the current long-term interest rate (minus a liquidity premium) considered to be the average of the successive expected short-term interest rates (see Omondi 2016). In the situation where the long-term interest rate is higher (lower) than the short-term interest rate, investors' expectation is that the future short-term interest rate will rise (decline), causing future bond prices to decrease (increase). We therefore expect that the number of stock IPOs is positively related to the yield curve. The short-term interest rate is defined as the interest rates for debts with a maturity of 1 year or less.<sup>11</sup> The long-term interest rate is defined as the interest rates for debts with a maturity of more than 1 year.<sup>12</sup>

We expect that the number of stock IPOs is positively related to the growth in the stock market level and negatively related to the volatility in this percentage of growth as a proxy for market uncertainty. We proxy the level of stock market prices by a time series for an

<sup>10</sup> Our time series for GDP is based on *Tweehonderd Jaar Statistiek in Tijdreeksen 1800–1999*, Chapter 9. We received the file with the data and used Column 17. For the missing values in this time series in the years 1914 until 1922, the yearly mutations in the consumer index corrected National Income are used from *111 Jaar Statistiek in Tijdreeksen 1899–2010*, Table 7a, page 86, Nationaal Inkomen netto marktprijzen and Table 17, page 180, consumenten-prijnsindex, and aligned with the other data. The value for 1930 and 1969 is calculated as the average value of the previous and the next year. For the missing values of 1940 until 1949, the values of the changes in the net domestic product of the same years (Column 16 in the data file from CBS) are used and aligned with the other data. From 1995 up and including 2015, the data from Statline are used and aligned.

<sup>11</sup> Our time series for the short-term interest rate from 1876 until 1996 is based on *Tweehonderd Jaar Statistiek in Tijdreeksen 1800–1999*, Column 2, page 101 (Centraal Bureau voor de Statistiek 2001). The interest rate for 1914 is calculated as the average interest rate from 1913 and 1915. For the years 1996–1998, the interest rate of the Aibor (*De Nederlandse Bank, Statistisch Bulletin 2003–2010*, page 70, Aibor 12 months) is used and for the years 1999 until 2016 the interest rate of the Euribor (DNB Statistisch Bulletin, Euribor 12 months) is used.

<sup>12</sup> Our time series for the long-term interest rate from 1876 until 1996 is based on *Tweehonderd Jaar Statistiek in Tijdreeksen 1800–1999*, Column 1, page 101 (Centraal Bureau voor de Statistiek 2001). The missing interest rate for 1945 is calculated as the average interest rate from 1944 to 1946. For the years 1996 until 2016, the interest rate for Dutch 10 year Government Bonds (DNB Statistisch Bulletin, Kapitaalmarkt-rentevoeten, most recent 10 years) is used.



equity index.<sup>13</sup> Since the increase of the stock market index is partially caused by inflation (Lerner 1994), we use an index that is deflated by the purchasing power of the Dutch guilder or euro.<sup>14</sup> The yearly return in the stock market index is calculated by dividing the yearly absolute growth in stock level by the absolute value of the level from the previous year. The volatility is calculated as the variance over the past 2 years and the year itself. For both the return and volatility, we use the original values (not corrected for inflation) of the stock market level. We add the variable stock market development because this affects the allocation of financial resources. Since firms have several means to obtain finance, more firms will publicly issue stock when stock markets become more important in a country's capital market. An indicator of the importance is the ratio of the number of publicly traded domestic firms, whose stock is publicly traded in a domestic stock exchange to the country's population in millions (Rajan and Zingales 2003). We therefore expect that the number of stock IPOs is positively related to this ratio.<sup>15</sup>

#### 4. Methods

In order to explain yearly fluctuations in the number of IPOs and especially the causes of hot markets, we first develop a time series regression model with the number of offerings as our explained variable. We thus run time series regression models to explain the number of IPOs and apply 3 year moving average values of the explanatory variables for the 2 years before the IPO and the year of the IPO. We also use yearly values with a lag of 1 year in a robustness check. Since we have no data for the size of the IPOs, we cannot perform a robustness check with the IPO volume. When time series are nonstationary, there is a heightened risk of spurious regressions and the regression estimators are likely to be adversely affected (Dougherty 2007). To overcome this problem, Lowry (2003) and Pastor and Veronesi (2005) de-trend the time series of IPOs by deflating the number of IPOs in a certain period by the number of public firms at the end of the previous period. Because the correlogram of the 1st-order autocorrelation of our IPO time series shows no signs of a nonstationarity and because we added the number of listed funds per million inhabitants as a variable to our model, we do not de-trend.

<sup>13</sup> Our time series for stock market level is from 1899 until 2010 based on *III Jaar Statistiek in Tijdsreeksen 1899–2010*, Table 16b, page 172 (Centraal Bureau voor de Statistiek 2010). The index from 1899 is in this time series set to 100. The values for 1945 and 1946 are calculated via linear interpolation. For the years 1876 until 1889, the values from *Index Aandelen: De Algemene Banken en het Effectenbedrijf 1860–1914* (Geljon 2005, Attachment 5) are used. The index from 1860 is in this time series set to 100. This time series is aligned with the 1st one. The data from 2010 until 2016 come from the all Share Index Nederland (De Nederlandse Bank 2016) and aligned.

<sup>14</sup> Our time series for inflation from 1876 until 2011 comes from the International Institute of Social History, value of the Guilder/Euro on [www.iisg.nl](http://www.iisg.nl). The time series from 2011 until 2016 comes from CBS.

<sup>15</sup> Our time series for the total number of listed funds on the stock market in Amsterdam from 1876 to 1898 is based the *Nieuw Algemeen Effectenblad* from the end of December of each year. The data from 1898 until 1889 and from 1941, 1943, and 1945 are based on the database from Record Management & Archives from NYSE EuroNext. The data from 1900 until 1962 come from the annual report from the Amsterdam Stock Exchange of 1961. The value for 1940 comes from *Een Eeuw vol Effecten* (De Vries 1976, page 126) and the values of 1942 and 1944 are calculated via linear interpolation since no data are available for those years. The data from 1962 until 1998 come from several annual reports from the Amsterdam Stock Exchange and from 1998 to 2005 from the *Officiële Prijscourant* from the end of December of each year. The data from 2005 until 2016 come from the EuroNext Factbook 2011 and 2015. The time series for the inhabitants of the Netherlands from 1876 to 1998 is based on *Tweehonderd Jaar Statistiek in Tijdsreeksen 1800–1999*, Chapter 2, page 14, Table 2, Column 1. From 1998 until 2016, the data are used from Statline Bevolking kerncijfers (Centraal Bureau voor de Statistiek 2016).

The time series regression allows us to estimate the relevance of economic, market, and institutional variables on the fluctuation of stock IPOs. The time series of the IPOs obviously has a 1st-order autocorrelation and therefore we use Newey–West estimators (Newey and West 1987) instead of a standard linear regression model. We use the natural log of the values for the time series for stock market level and for the number of IPOs. In summary, the OLS-model for the number of IPOs in year  $t$  is

$$\begin{aligned} LN(1 + NO\ IPO_t) = & Constant + \beta_1 GDP\ GROWTH_{t-t-2} + \beta_2 INTEREST\ RATE_{t-t-2} \\ & + \beta_3 YIELD_{t-t-2} + \beta_4 STOCK\ INDEX_{t-t-2} + \beta_5 STOCK\ RETURN_{t-t-2} \\ & + \beta_6 STOCK\ VOLATILITY_{t-t-2} + \beta_7 NO\ FUNDS_{t-t-2} + \varepsilon_t. \end{aligned}$$

The explained variable  $NO\ IPO_t$  is the natural log of one plus the number of stock IPOs in year  $t$ . This variable is regressed on the values of the explanatory variables for growth in GDP ( $GDP\ GROWTH_{t-t-2}$ ), long-term interest rate ( $INTEREST\ RATE_{t-t-2}$ ), spread between the long-term and short-term interest rates ( $YIELD_{t-t-2}$ ), natural log of the stock market index level ( $STOCK\ INDEX_{t-t-2}$ ), stock market return ( $STOCK\ RETURN_{t-t-2}$ ), volatility in stock market return ( $STOCK\ VOLATILITY_{t-t-2}$ ), and number of funds, representing the level of development of the Amsterdam Stock Exchange ( $NO\ FUNDS_{t-t-2}$ ).

This model does not fully explain the number of IPOs. Therefore, we confront the actual number of stock IPOs per year with the predicted number of IPOs from our model, in the 2nd part of our analysis. By identifying periods in which the differences between predicted and actual numbers are large, we investigate whether additional period-specific motivations for an IPO emerge. Here, our approach adds detailed context and narratives. A key source for this analysis is Delpher, a repository of digitized newspapers. We use key words searches to find discussions among contemporaries about IPO activity.

## 5. Descriptive statistics

In table 1 and figures 1 and 2, we describe our data set. The data show that the number of IPOs clusters not only in time but also in industries as depicted in figure 2.

Figure 1 has the number of listed funds (for both stocks and bonds) on the Amsterdam Stock Exchange. Figure 2 shows that from the start in 1876, the number of IPOs increases, and in the years around the First World War, the number of IPOs reaches its maximum in 1917 and 1920. The large number of IPOs in the earliest years is consistent with patterns in other countries. For example, Van Nieuwerbrugh *et al.* (2006) show similar findings in Belgium and Campbell *et al.* (forthcoming) mention that, in the UK, between 1829 and 1929, thousands of companies were listed. Recessionary periods are also clearly visible; see, for example, the low number of IPOs in the early 1930s. Another noticeable fact is that IPOs of firms active in agriculture emerge after 1880 but disappear in the 1950s. These are firms that are mainly active in the Dutch East Indies. In table 1, we provide descriptive statistics.<sup>16</sup>

<sup>16</sup> We have capped growth in GDP for our time series regression model at the 5th and 95th percentile of the raw data to prevent that the unusual high growth and decline rates in GDP around the First and Second World War influences our model too much. We have not removed other outliers or capped variables. We have investigated the correlations between the variables of the data and conclude that multicollinearity is not an issue.

Table 1. *Descriptive statistics*

Period/statistic	No. IPO	No. IPO (2nd tier)	GDP growth	Interest rate	Yield	Stock index	Stock return	Stock volatility	No. funds	No. inhabitants	Inflation rate
1876–1890	81	0	0.7	3.7	0.2	70.4	-0.1	0.001555	414	4.21	-1.0
1891–1905	187	0	2.2	3.0	-0.1	90.2	3.0	0.002069	968	5.05	0.1
1906–1920	355	0	3.3	3.9	0.4	119.6	0.9	0.007818	1817	6.23	5.1
1921–1935	146	0	2.6	4.1	1.2	57.1	-6.4	0.021546	2726	7.74	-3.9
1936–1950	93	0	2.3	3.2	2.0	80.5	8.7	0.035901	1794	9.25	5.6
1951–1965	153	0	4.7	4.0	1.6	239.9	10.2	0.039324	2187	11.29	3.0
1966–1980	45	0	3.7	7.0	0.2	356.9	3.5	0.052096	2168	13.44	6.1
1981–1995	112	58	2.2	6.9	0.2	1150.6	13.3	0.043569	1877	14.85	2.4
1996–2015	91	16	1.9	3.8	1.2	4163.0	6.8	0.047220	1567	16.34	1.9
Average	9	0.5	2.6	4.4	0.8	826.7	4.5	0.028590	1719	10.05	2.1
St. deviation	9.1	2	3.6	1.6	1.3	1460.6	17.8	0.038104	686	4.29	4.5
Minimum	0	0	-5.1	0.7	-3.6	28.0	-51.5	0.000034	238	3.86	-14.8
5th percentile	0	0	-5.1	2.8	-1.0	51.8	-21.0	0.000236	416	4.20	-4.4
25th percentile	2	0	0.4	3.2	-0.2	77.9	-4.1	0.002566	1337	6.01	0.0
Median	6	0	2.9	3.9	0.8	116.5	3.1	0.011128	1837	9.42	2.1
75th percentile	13	0	5.1	5.0	1.7	423.8	11.5	0.046492	2201	14.23	3.8
95th percentile	24	3	8.6	7.8	2.6	4398.6	36.9	0.097113	2812	16.49	9.3
Maximum	49	14	8.6	9.1	3.8	6195.0	68.0	0.202275	2947	16.98	16.0

This table presents descriptive statistics for 15 year periods (20 years for 1996–2015) and the full sample. No. IPO is the number of IPOs, while 2nd tier refers to the subset that is listed on the secondary market; GDP growth is the annual growth in GDP; interest rate is the long-term interest rate; yield is the spread between the long-term and short-term interest rate; stock index is the stock market index level of the Amsterdam Stock Exchange; stock return is the annual return in the stock index; stock volatility is variance of the stock market return; No. funds is the number of listed funds; No. inhabitants is the number of inhabitants of the Netherlands; and inflation rate is the annual rate of inflation. The main sources are the *Gids bij de Officiële Prijscourant* and *Tweehonderd Jaar Statistiek in Tijdsreken 1800–1999*; all other sources are defined in Section 3.

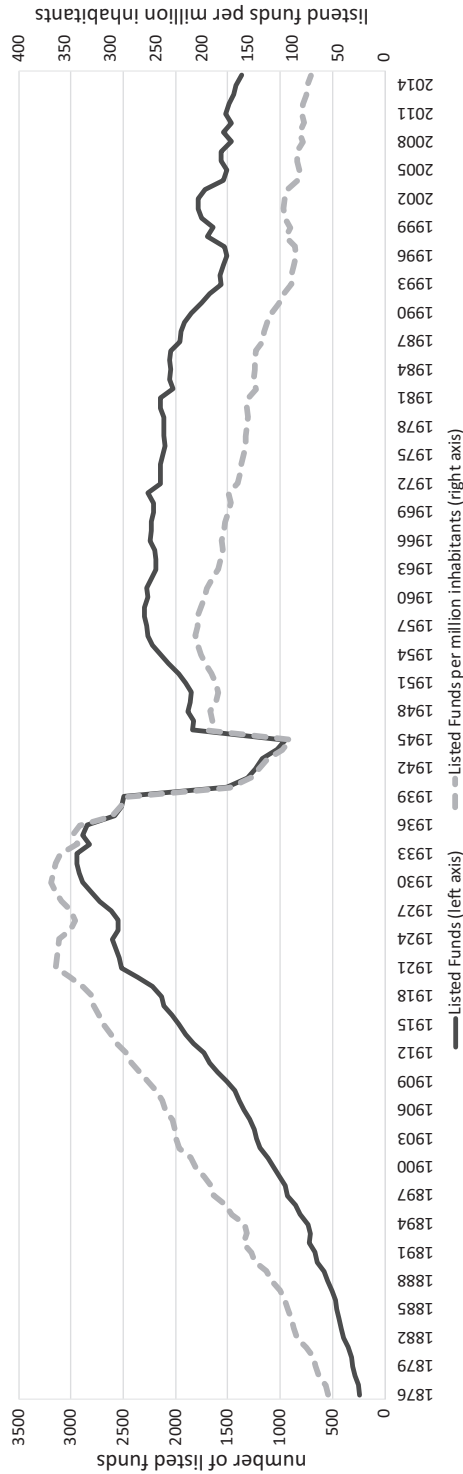


Figure 1. Number of listed securities. This figure shows for the Amsterdam Stock Exchange the number of listed stocks and bonds (black solid line, left axis) and the number of listed stocks and bonds per million inhabitants of the Netherlands (gray dashed line, right axis). The main sources are the Gids bij de Officiële Prijscourant and Tweehonderd Jaar Statistiek in Tijdreeksen 1800–1999; all other sources are defined in Section 3.

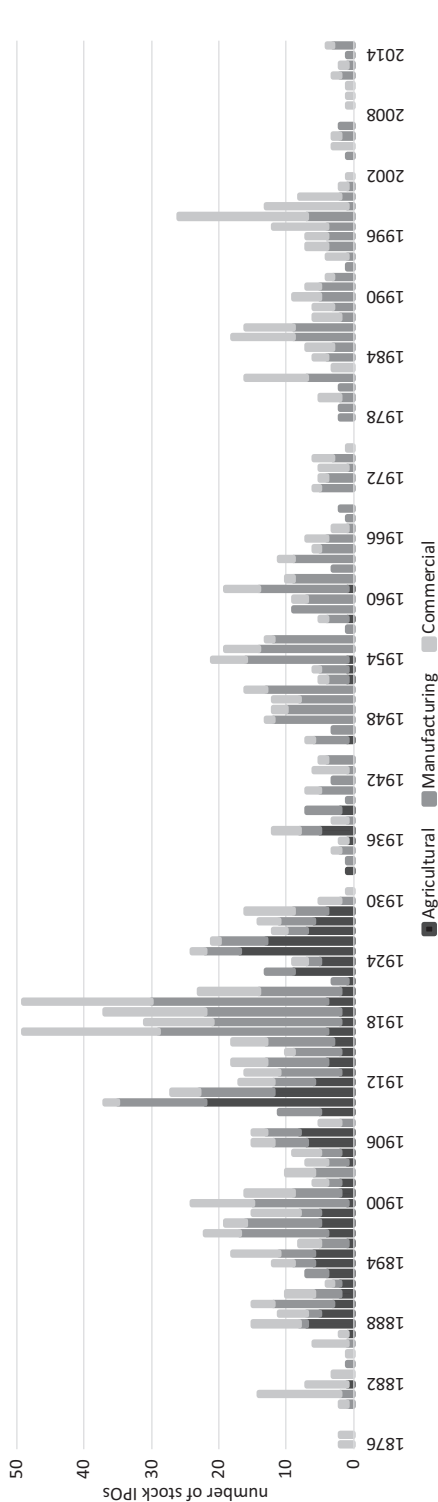


Figure 2. Time series of IPOs. This figure shows for the Amsterdam Stock Exchange the number of IPOs per year for agriculture (black), manufacturing (dark gray), and commercial activities (light gray). The source is the Gids bij de Officiële Prijscourant.

Table 2. *Determinants of the number of IPOs*

	(1) LN(1+ no. IPOs)	(2) LN(1+ no. IPOs)	(3) LN(1+ no. IPOs)
Constant	2.28*** (0.000)	2.49*** (0.002)	0.23 (0.828)
GDP growth	15.91*** (0.000)	13.76*** (0.000)	9.10** (0.017)
Interest rate	-16.08** (0.019)	-9.36* (0.051)	-4.84 (0.319)
Yield	-10.39 (0.268)	-1.30 (0.896)	-4.62 (0.555)
Stock index		-0.07 (0.697)	0.23 (0.209)
Stock return		2.33*** (0.000)	2.97*** (0.000)
Stock volatility		-10.99*** (0.003)	-11.15*** (0.001)
No. funds			0.004*** (0.007)
Observations	140	140	140
R-squared	0.24	0.39	0.49
Adjusted R-squared	0.22	0.36	0.46

This table presents OLS regressions explaining the natural logarithm of 1 plus the number of IPOs in a year ( $t$ ). The explanatory variables are averaged over 3 years ( $t-2$  until  $t$ ). GDP growth is the annual growth in GDP; interest rate is the long-term interest rate; yield is the spread between the long-term and short-term interest rates; stock index is the natural log of the stock market index level of the Amsterdam Stock Exchange; stock return is the annual return in the stock index; stock volatility is the variance of the stock market return; and no. funds is the number of listed funds per million inhabitants. The main sources are the *Gids bij de Officiële Prijscourant* and *Tweehonderd Jaar Statistiek in Tijdreeksen 1800–1999*; all other sources are defined in Section 3. We present regression coefficients and  $p$ -values based on Newey–West (1987) corrected standard errors.

\*\*\* 1 percent.

\*\* 5 percent.

\* 10 percent.

Our data contain in total 1,263 stock IPOs. The descriptive statistics in table 1 shows that the number of IPOs in a given year is nine on average. The mean GDP growth is 2.6 percent and the average interest rate and yield are 4.4 percent and 0.8 percent, respectively. Periods with high interest rates are in the last decades of the twentieth century. Overall, these descriptive statistics are in line with the developments of the Dutch economy and stock market.

## 6. Time series regression model

In table 2, the outcome of our regression is presented with the 3 year moving average values of the explanatory variables. The regression is done in three steps. We first include the variables for general economic conditions and estimate the effect on the number of IPOs. In subsequent models, we add the stock market variables and the number of funds.

We find that GDP growth is significantly positive related to the number of IPOs, in all three models. This is according to our expectation and supports the literature that the proceeds of IPOs are used to finance growth and investment opportunities. The level of the interest rate is significantly related to the number of IPOs, but only in the 1st and 2nd models. Once the number of funds is added, the interest rate becomes insignificant. The yield is not related to the number of IPOs.

Stock market returns and volatility are significantly related to the number of IPOs, and both with the expected sign. The positive effect for stock market return is an indication that issuers time their IPO. This is supported by the result that the number of IPOs is strongly negatively related to the volatility in stock market return, an indication that periods with high uncertainty among investors are avoided. These findings are in line with the findings of Pastor and Veronesi (2005) and Choe *et al.* (1993). The stock market level is not statistically significant. The level of development of the stock exchange, proxied by the number of funds, is significantly positively related to the number of IPOs, which is in line with our prediction based on the findings of Rajan and Zingales (2003).

The explanatory power of our model, measured by the  $R^2$ , increases from 0.24 to 0.49 in the last step. This means that our model explains almost 50 percent of the fluctuations in the number of IPOs. To check the validity of our results, we perform several robustness checks. The results are presented in table 3.

In the 1st robustness check, we lag all variables by 1 year. This way, we do not include information from the year of the IPO because all explanatory variables are measured over year  $t-1$ , until  $t-3$ . The results are similar; except that GDP GROWTH becomes insignificant once the variable for stock market development is added. In the 2nd robustness check, we remove the IPOs from firms that are active in the Dutch East Indies. The reason is that we use growth in GDP as a proxy for economic growth, only based on GDP in the Netherlands. However, for firms active in the Dutch East Indies, it is not likely that the number of IPOs has a strong relation with the growth in GDP of the motherland. Again, the results are quite similar to the regression described above, except that the level of stock market development is not significant anymore.<sup>17</sup>

In the 3rd robustness analysis, we capture timing decisions that are based on information with a shorter horizon. We regress the natural log of the number of IPOs with the yearly values with a lag of 1 year. The results show that the same variables are significant as in the regression in table 2 with the 3 year moving average. The R-squared, however, is lower. In the 4th and final robustness check, we use the unscaled number of IPOs, instead of the log specification. Again, the results are quite similar except for the fact that GDP is not significant anymore.

<sup>17</sup> We conduct an additional robustness analysis (results are available upon request), where we include the economic development in the Dutch East Indies in our model. We use Van der Eng's (1992) time series of Indonesian GDP for the years 1880–1989 to construct an additional variable, which is GDP growth in Indonesia. The influence of the growth of the Indonesian economy only applies to the years before the Second World War because after the Japanese occupation in 1942, no new IPOs for colonial companies are introduced and at the end of the war in 1945 Indonesia was declared independent, a status that was recognized by the Dutch government in 1949. We add this variable GDP growth in Indonesia to Model (3) in table 2 and estimate our model for the period 1883–1941. The average of this variable is 0.72 percent with a standard deviation of 2.06 percent; the variable ranges between –4.99 percent and 5.11 percent. The results show that the GDP growth in Indonesia is not a significant factor. However, the correlation with GDP growth in the Netherlands is 0.53, which explains the reduction in significance level of GDP growth in the Netherlands.

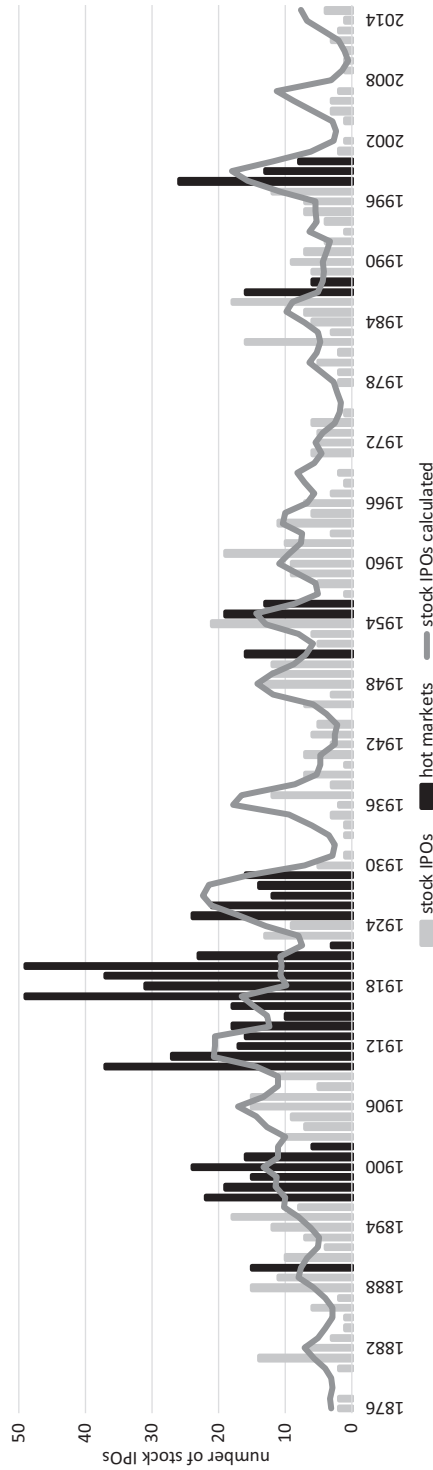
Table 3. Robustness analyses

Explained variable	Natural log IPOs						Absolute number IPOs					
	3 year average, lag 1 year			3 year average			Yearly, lag 1 year			3 year average		
	All IPOs			Without IPOs from Dutch East Indies			All IPOs			All IPOs		
Lag structure	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Sample	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	LN( <i>t</i> + no. IPOs)	no. IPOs	no. IPOs	no. IPOs
Constant	2.40*** (0.000)	2.91*** (0.001)	0.78 (0.516)	1.62*** (0.000)	1.37* (0.062)	0.13 (0.906)	2.31*** (0.000)	2.66*** (0.000)	1.45** (0.036)	11.78*** (0.000)	10.50 (0.145)	-17.57 (0.201)
GDP growth	10.73*** (0.002)	8.31*** (0.008)	3.92 (0.284)	13.85*** (0.000)	11.47*** (0.000)	8.91** (0.028)	10.30*** (0.000)	9.25*** (0.001)	7.27** (0.018)	109.78*** (0.001)	93.41*** (0.004)	35.60 (0.421)
Interest rate	-15.89** (0.031)	-9.27* (0.071)	-4.83 (0.356)	-6.69 (0.295)	-0.89 (0.836)	1.60 (0.748)	-14.19** (0.039)	-5.47 (0.305)	-6.27 (0.184)	-120.22** (0.021)	-57.63 (0.322)	-1.38 (0.983)
Yield	-7.78 (0.416)	0.94 (0.925)	-2.25 (0.779)	-0.46 (0.963)	7.40 (0.424)	5.57 (0.494)	-5.82 (0.425)	-1.92 (0.805)	-5.12 (0.447)	-40.24 (0.661)	48.77 (0.696)	7.56 (0.930)
Stock index		-0.13 (0.479)	0.14 (0.500)		0.035 (0.822)	0.20 (0.305)		-0.109 (0.156)	0.015 (0.874)		0.06 (0.967)	3.75* (0.085)
Stock return		2.97*** (0.000)	3.57*** (0.000)		2.67*** (0.000)	3.02*** (0.000)		1.63*** (0.000)	1.81*** (0.000)		13.64*** (0.005)	21.57*** (0.001)
Stock volatility		-11.87*** (0.008)	-12.00*** (0.007)		-9.92*** (0.006)	-10.01*** (0.004)		-7.37** (0.013)	-8.02*** (0.009)		-91.61*** (0.032)	-93.64** (0.016)
No. funds		0.004** (0.023)			0.002 (0.163)				0.003* (0.065)			0.055** (0.017)
Observations	139	139	139	140	140	140	139	139	139	140	140	140
R-squared	0.14	0.34	0.43	0.18	0.36	0.40	0.19	0.35	0.41	0.13	0.22	0.38
Adjusted	0.12	0.31	0.40	0.17	0.33	0.37	0.17	0.32	0.37	0.11	0.18	0.35
R-squared												

This table presents OLS regressions. In Models (1)–(3), we explain the natural logarithm of *I* plus the number of IPOs in a year (*t*) and the explanatory variables are averaged over 3 years (*t-3* until *t-1*). In Models (4)–(6), we explain the natural logarithm of *I* plus the number of IPOs excluding IPOs by firms active in Indonesia in a year (*t*) and the explanatory variables are averaged over 3 years (*t-2* until *t*). In Models (7)–(9), we explain the natural logarithm of *I* plus the number of IPOs in a year (*t*) and the explanatory variables are measure over 1 year (*t-1*). In Models (10)–(12), we explain the number of IPOs in a year (*t*) and the explanatory variables are averaged over 3 years (*t-3* until *t-1*). GDP growth is the annual growth in GDP; interest rate is the long-term interest rate; yield is the spread between the long-term and short-term interest rate; stock index is the natural log of the stock market index level of the Amsterdam Stock Exchange; stock return is the annual return in the stock index; stock volatility is the variance of the stock market return; and no. funds is the number of listed funds per million inhabitants. The main sources are the *Gids bij de Officiële Prijscourant* and *Tweehonderd Jaar Statistiek in Tijdscheen 1800–1999*; all other sources are defined in Section 3. We present regression coefficients and *p*-values based on Newey–West (1987) corrected standard errors.

\*\*\* 1 percent.  
 \*\* 5 percent.  
 \* 10 percent.





**Figure 3. Time series IPOs: actual and predicted. This figure shows the number of IPOs per year in bars. The years with hot markets (a year in which the 3 year moving average of the number of IPOs is in the highest quartile of the data set) are in black, while non-hot markets are in gray. The gray line represents the predicted number of IPOs as explained by Model (3) in table 2; the explained values are obtained by filling out the values for explanatory variables in the model with regression estimates. The source is the Gids bij de Officiële Prijscourant and authors' calculations.**

Table 4. Overview of hot markets

(1) Actual hot market years	(2) Explained hot market years	(3) Hot market years, not explained
1890	None	1890
1897–1902	1900–1902	1897–1899
1910–1922	1910–1919	1920–1922
1925–1929	1925–1929	None
1951	None	1951
1955–1956	1955–1956	None
1987–1988	None	1987–1988
1998–2000	1999–2000	1998

This table shows for the Amsterdam Stock Exchange in Column (1) all years with hot markets (a year in which the 3 year moving average of the number of IPOs is in the highest quartile of the data set). In Column (2), the hot years from Column (1) are included in case the explained number of IPOs as explained by Model (3) in table 2 would also be classified as hot (the explained values are obtained by filling out the values for explanatory variables in the model with regression estimates). In Column (3), all years from Column (1) are reported that are not in Column (2); these are years that are not predicted to be hot years. The source is the *Gids bij de Officiële Prijscourant* and authors' calculations.

We conclude that the 3rd model in table 2 is a good model to explain the number of IPOs. In the next step, we use the model to predict the number of IPOs in a given year. This prediction represents the number of IPOs based on fundamentals such as GDP growth and stock returns. In other words, if only the explanatory variables would explain the IPO fluctuations, then these are the number of IPOs we expect to observe. The solid line in figure 3 represents the predicted number of IPOs.

Figure 3 also shows the actual number of IPOs in bars, where the hot markets—defined as in Helwege and Liang (2004) as years in which the 3 year moving average is in the highest quartile—are shown in black bars and the other years are in gray. In total, we have 33 years with hot IPO markets. We observe that the predicted number of IPOs (the solid gray line) fluctuates with the actual number, but not perfectly.

Table 4 presents an overview with all years that have a hot IPO market.

The 1st hot market occurs in 1890. When we predict the number of IPOs for 1890, we do not find a number in the highest quartile. Therefore, 1890 is a hot market that cannot be explained by economic fundamentals. The next hot market starts in 1897 and ends in 1902. Of these 6 years, our model can explain the last 3 years, but the other 3 years remain unexplained. We define years in which the predicted hot markets from our model coincide with actual hot markets as the *explained* hot market. Other years with a hot market are *unexplained* hot market years. Of the thirty-three hot market years, as many as twenty-two are explained by the model, while another eleven remain unexplained. Since we aim to explain all hot markets, the years with the unexplained hot markets are the focal points for our in-depth historical analysis in the next section.

## 7. In-depth historical analysis

In this section, we give a description of the years with hot markets and aim to infer the causes of the unexplained hot markets from the historical context.

*7.1. Hot market 1890: the emerging Dutch East Indies*

The hot market in 1890 is not explained by our model. The total number of IPOs in this year is 15 and eleven IPOs are from so-called free-standing companies (Wilkins 1998): eight were active in the Dutch East Indies, two in South Africa and one in Germany. The year 1890 was the first year in which the *Cultuurstelsel* for the cultivation of sugar in the Dutch East Indies was completely abolished. As mentioned earlier, this abolishment was a trigger for the foundation of many new firms that were active in the Dutch East Indies and since 1881 the number of IPOs from firms active in the Dutch East Indies on the Amsterdam stock exchange increased every year. In the second half of the nineteenth century, the main source of finance for Dutch firms was retained earnings, supplemented with contributions by members of the founding families and closely connected wealthy individuals (De Jong and Röell 2006). For the free-standing companies, especially for the firms active in the Dutch East Indies, these resources of finance were not available (Gales and Sluyterman 1998). The firms that issued an IPO in 1890 were relatively young at the time of their IPO (average of 1.4 years), making them risky and active in a region with uncertain prospects. Next to this, the Dutch East Indies had hardly a stock market of its own and the banks in the Dutch East Indies were unwilling to provide firms with capital as they were still struggling to survive the 1884 sugar crisis. For these reasons, many of these firms turned to the Amsterdam stock exchange for finance.

*7.2. Hot markets 1897–1902: intensifying world trade*

The 1st 3 years of this period with hot markets are not explained by our model. The total number of IPOs in this period is 102 containing 44 IPOs of firms active in the Dutch East Indies, of which 17 were active in agriculture, 19 in manufacturing, and 8 in commercial services. From the manufacturing firms in the Dutch East Indies, sixteen of them were active in mining. In table 5, an overview is presented of the IPOs per industry for each hot market.

From the total number of IPOs in this period, twenty-two IPOs are by firms active in the sector transport. This period can be characterized by the increasing role of the Dutch East Indies in the Dutch economy and lies within a longer period with an intensifying world trade due to the increasing number of countries that used the gold standard, which introduced fixed exchange rates with a great part of the world.<sup>18</sup> In this period, the abolishment of the *Cultuurstelsel* in the Dutch East Indies was nearly completed. This abolishment led to the founding not only of many new agricultural firms but also, triggered by the spectacular growing demand on the world markets at the end of the nineteenth century, of firms active in the oil and mining industry. The Dutch East Indies were also important for domestic firms. Because of the small home market, many domestic firms were at that time export orientated (Sluyterman 2003). For the Dutch textile industry, the largest industry in the Netherlands at that time (measured by the number of employees), the Dutch East Indies and Asia were the most important export markets. The Dutch harbors were trade centers for the Western world (Sluyterman 2003), which gave an impulse to the Dutch shipping industry and to firms active in loading, unloading, and storage of goods. By the end of the nineteenth century, the sentiment of investors to invest in free-standing companies active in the Dutch East Indies had

<sup>18</sup> Between 1870 and 1913, the average rate of growth of merchandise exports was worldwide 3,4 percent per year (Maddison, 2006), much higher than between 1820 and 1870.

Table 5. Industry distribution of IPOs in hot markets

Sector	Code	1876–1890	1897–1902	1910–1922	1925–1929	1951	1955–1956	1987–1988	1998–2000
	SBI	2015	19	66	47	0	0	0	0
<b>Agriculture and fishing:</b>									
Agriculture, forestry and fishing	01–03	222	3	19	66	47	0	0	0
<b>Manufacturing and construction:</b>									
Exploration of and services for the expl. of oil, gas, and minerals	06–09	84	5	31	14	2	0	0	1
Production of beverage, food, tobacco, shoes, textile, and clothing	10–15	171	4	7	59	8	5	7	1
Production of timber, paper, and cardboard	16–17	24	0	0	7	1	1	2	0
Printing and reproduction of recorded media	18	5	0	0	0	0	1	0	0
Production of coke oven, chemical, rubber, and pharm. products	19–23	82	0	4	19	5	0	1	3
Production of metal products (no machines)	24–25	61	0	4	10	3	3	3	1
Production of computers and electrical and electronic equipment	26–27	41	0	0	9	3	0	2	1
Production and repair of machines, cars, and other goods	28–33	102	0	1	32	2	3	8	3
Production and exploration of electricity, gas, water, and waste	35–39	18	0	3	9	0	0	0	0
Civil and commercial construction	41–43	29	0	0	9	0	1	2	0
<b>Commercial services</b>									
Trade (wholesale and retail sale)	45–47	140	0	7	54	9	1	5	1
Transport over water, land, by air, including storage and services	49–52	125	3	22	34	1	0	1	0
Mail and couriers	53	4	0	0	1	0	0	0	1
Lodging, restaurants, and bars	55–56	12	0	1	3	0	0	0	0
Publishers, production of movies, and broadcasting of radio and TV	58–60	20	0	0	1	0	1	0	2
Telecommunication, ICT, and services for ICT	61–63	52	0	0	0	0	0	0	29
Financials	64–66	0	0	0	0	0	0	0	0
Real estate	68	45	0	3	8	4	1	0	0
Legal services, accountancy, tax consultants, and holdings	69–70	7	0	0	0	0	0	0	0
Architects, engineers, and technical design and services	71	4	0	0	0	0	0	0	0
Investigate and development, commercial and market research	72–73	1	0	0	0	0	0	0	0
Other commercial services	74–82	14	0	0	0	2	0	0	4
<b>Total</b>		<b>1,263</b>	<b>15</b>	<b>102</b>	<b>335</b>	<b>87</b>	<b>16</b>	<b>32</b>	<b>47</b>

This table shows the industry distribution for the Amsterdam Stock Exchange with the total number of IPOs and the number of IPOs in each of the eight hot markets (years in which the 3 year moving average of the number of IPOs is in the highest quartile of the data set). The source is the *Gids bij de Officiële Prijscourant*.

also changed. Investors were reluctant toward investments in these firms, in previous years, but in 1897, the sentiment toward firms active in the Dutch East Indies became positive.<sup>19</sup>

### 7.3. *Hot markets 1910–1922 and 1925–1929: the stock market integrates into the economy*

The hot markets in the period 1910–1922 are predicted by our model, except for the years 1920–1922. The period between 1910 and 1929 can be characterized by three aspects. First, the trends from the previous period with hot markets continue. The role of the Dutch East Indies in the Dutch and global economy was still increasing, only temporarily interrupted by the First World War when transport from and to the Netherlands was blocked (Sluyterman 2003). Second, because the Netherlands was neutral during the First World War, its position in trade increased (Sluyterman 2003). Third, due to the *laissez-faire* approach of the Dutch government the Amsterdam stock exchange became more important for capital markets. Although almost the entire period between 1910 and 1929 consists of hot markets, the distribution of IPOs over the industries varied enormously, as shown in table 5. In the beginning and end of this period, agricultural firms (mainly active in the Dutch East Indies) were dominant but almost absent in the period from the First World War until the mid-1920s. In contrast, the number of IPOs peaked in 1917 and 1920 to an all-time high, mainly by firms active in manufacturing and in commercial services.

### 7.4. *Hot markets 1951 and 1955–1956: modernization*

The hot market in 1951 is not predicted by our model, while the one in 1955–1956 is. The total number of IPOs in 1951 is sixteen, of which thirteen IPOs are by industrial firms. The total number of IPOs in 1955 and 1956 is thirty-two from which twenty-six IPOs came from firms active in manufacturing, while none of these forty-eight firms was active in the Dutch East Indies because on 17 August, 1945, the independent state of Indonesia was proclaimed and the Dutch retreated in 1949. A typical characteristic of the Dutch industrial firms in the 1st half of the twentieth century is that these firms were family firms that made little use of capital markets and banks. These firms funded activities mainly through internal financing, which was possible due to the government's low wage policy (De Jong *et al.* 2010).<sup>20</sup> However, after the Second World War family firms were considered to be out of date. In the spirit of modernization, these firms were considered to be too small and inefficient since they were not run by highly skilled managers (Sluyterman 2003). Due to increasing export and growing domestic consumption, the Dutch manufacturing industry reached its maximum capacity in the mid of the 1950s. The growth of industrial production stagnated after a long period of expansion because the possibilities to further improve the utilization rate of the existing equipment were becoming increasingly limited.<sup>21</sup> The unemployment was low and in some industries, there was a shortage of labor.<sup>22</sup> As a consequence, wages rose which lead to increasing costs which influenced the competitiveness of the Dutch manufacturing industry on European and world markets.<sup>23</sup> In order to be able to compete, investments were needed to replace obsolete machineries. This was especially the case for the textile industry

<sup>19</sup> Annual Report Vereeniging voor den Effectenhandel, 1897.

<sup>20</sup> Annual Report Vereeniging voor den Effectenhandel, 1955.

<sup>21</sup> Annual Report De Nederlandsche Bank, 1955, page 19.

<sup>22</sup> Annual Report Vereeniging voor den Effectenhandel, 1954.

<sup>23</sup> Annual Report Vereeniging voor den Effectenhandel, 1955.

(Sluyterman 2003) which lost an important export area with the independence of Indonesia. The family capital was considered to be insufficient and as a consequence, many family firms turned into a limited liability structure in the 1950s and went public.<sup>24</sup>

#### 7.5. Hot markets 1987–1988: a window of opportunity

In total, there were twenty-two IPOs in these 2 years and these hot markets are not predicted by our model. However, the year 1988 is defined as a hot market because of the high number of IPOs in 1986 (eighteen) and 1987 (sixteen); therefore, these are the years of interest for our in-depth analysis. In total, there were thirty-four IPOs in these years, while the number of IPOs from ICT-related firms is eleven, five from firms active in hardware production and six from firms active in services. In the early 1980s, the Netherlands was in a deep economic recession and the short-term interest rate was at a record high. Due to budget cuts, low inflation, productivity improvements, and a decrease of the short-term interest rate, the economic tide changed.<sup>25</sup> Equity investments became popular among retail investors in the mid-1980s, especially for listed investment funds.<sup>26</sup> Together with the capital from institutional investors who had made huge profits on their investments in government bonds, the investments from retail investors lead to a high amount of capital that flooded to the stock markets. In addition to this, the Amsterdam Stock Exchange had also attracted the attention of foreign investors, who had noticed that Dutch stocks were undervalued.<sup>27</sup> This led to a bull market that ended on 19 October, 1987, Black Monday. The period with high stock market returns and positive sentiment among investors was a fertile era for IPOs. Investors were particularly positive about investments in local Dutch firms, caused by a strong decline in the value of the US dollar, which had a negative effect on the profits measured in Dutch guilders of international firms.<sup>28</sup> In the early 1980s, the application and use of electronics and personal computers became widespread. The so-called high-tech firms, which were made in or traded in hardware or software, were founded and especially these high-tech firms were popular among investors. Partly due to the start of the Official Parallel Market, the number of IPOs of these firms increased significantly and stock prices rose sharply.<sup>29</sup>

#### 7.6. Hot markets 1998–2000: the internet bubble

These series of hot markets are predicted by our model, except for the year 1998. In total, there were forty-seven IPOs, only ten from industrial firms and thirty-seven from firms active in commercial services. From these thirty-seven IPOs, twenty-nine were ICT firms.

Retail investors accounted for about 35 percent of trading in 1986<sup>30</sup>, but after the crashes in 1987 and 1989, they had almost disappeared from the Amsterdam Stock Exchange. In the late 1980s, a steering group was formed under the name *Amsterdam Internationaal Financieel Centrum*, headed by central bank president Duisenberg. The task for this group was to come up with recommendations to position the Amsterdam Stock Exchange as strongly as possible

<sup>24</sup> Annual Report Vereniging voor den Effectenhandel, 1955.

<sup>25</sup> Wassenaar agreement on 24 November, 1982.

<sup>26</sup> 120 Jaar Beurshandel in Vogelvlucht, Stichting Vereniging voor de Effectenhandel, 1998, page 26.

<sup>27</sup> “Damrak brak alle records”, *De Telegraaf*, 31 December, 1985.

<sup>28</sup> “Iets hogere dollarkoers blijft onder 1,80 gulden”, *Nederlands Dagblad*, 31 December, 1987.

<sup>29</sup> 120 Jaar Beurshandel in Vogelvlucht, Stichting Vereniging voor de Effectenhandel, 1998, page 30.

<sup>30</sup> 120 Jaar Beurshandel in Vogelvlucht, Stichting Vereniging voor de Effectenhandel, 1998, page 30.

on the international financial markets, and on 16 March, 1989, their report “Amsterdam: Financial Gateway to Continental Europe” was presented to the Minister of Finance.<sup>31</sup> Almost all of the recommendations were successively implemented. The 1st was to try to limit the use of takeover defenses and the 2nd was to lower transaction costs by creating more competition between stock brokers and banks and to lower taxes. In addition, the Amsterdam Stock Exchange changed their trading system in 1994. In the new Trading System Amsterdam, the wholesale and retail segments were separated for large and small transactions which provided more real-time information to retail investors. In 1995, the Amsterdam Stock Exchange noticed that the retail investor was back.<sup>32</sup> In 1996, approximately 700,000 retail investors were active in the Netherlands and this number grew to more than 1.5 million in the year 2000 (Smit 2010). To attract more listings, the Amsterdam Stock Exchange established in 1997 a 2nd tier, NMAX, which had lower entry requirements than the 1st official tier. In 1998, these entry requirements were lowered even further which was particularly favorable for young firms.

Investors, both institutional and retail, were particularly interested in IPOs of firms active in ICT. The IPOs of these firms were a great success based on a believe that ICT, and especially the internet, would radically change the way of living and that firms from the so-called New Economy had a bright future ahead of them in which they would make exceptional profits. The interest from investors was amplified by intense media coverage which created very optimistic assumptions about the fundamental value of these firms.<sup>33</sup> In the year 2000, the stock market crashed and the IPO of World-Online at the beginning of that year is exemplary for ICT-related IPOs in this period. This IPO was oversubscribed many times and attracted a great deal of attention from investors and media. However, it soon became clear that the expectations for this firm were not realistic (De Jong *et al.* 2014).

## 8. Conclusions

In this paper, we analyze the fluctuations in the yearly number of IPOs and the causes of hot markets in the Netherlands over the long period of 1876–2015. As Morck and Yeung (2011) describe, understanding complex economic phenomena requires econometric analyses, complemented with historical analyses. Numerous influences are at work simultaneously in different areas such as economics and politics and it would be naive to think that we can unravel the causes of hot IPO markets with simple regression models, especially over the long period we investigate. Both our approaches, econometrics and in-depth historical analysis, have strengths and weaknesses and we agree with Morck and Yeung (2011) that these strengths make both methods complementary.

What does our study contribute to our knowledge of Dutch economic history and the historical development of capital markets? First, we find that several drivers of new equity funding were persistent over the period of 140 years. The fluctuations in the number of IPOs can partially be explained by a set of economic and market variables that influence IPOs over the full period. Economic growth, stock market returns, and stock market volatility are strong drivers of the number of IPOs. Equity seems to be issued to finance growth and investment

<sup>31</sup> Annual Report De Nederlandsche Bank, 1989.

<sup>32</sup> 120 Jaar Beurshandel in Vogelvlucht, Stichting Vereniging voor de Effectenhandel, 1998, page 30.

<sup>33</sup> Normally used methods for valuation were considered to be inappropriate for these firms.

opportunities and windows of opportunity are used with enthusiastic investors, and periods with high uncertainty about investors' sentiment are avoided.

In addition, we find strong evidence that the importance of the stock market for capital markets, measured by the number of listed funds per million inhabitants, is an important driver for hot markets. Second, we find that in specific years, hot markets cannot be explained by econometric modeling because the IPOs are dominated by specific industries. Third, our study also shows that the roles of corporate law, security regulation, and government control are fairly limited. Although the roles of legislation and government intervention are important in the process of IPOs, they hardly affect the number of IPOs in our study.

Finally, we also call for further research. Similar to Van Nieuwerbrugh *et al.* (2006) for Belgium and Campbell *et al.* (forthcoming) for the UK, we find that the late nineteenth century and early twentieth century witnessed very large numbers of new listings, including many smaller firms. While our study can partially explain these large numbers, a further investigation into the specific period is warranted and this should be done in a comparative analysis of various markets.

### Acknowledgements

The authors like to thank Carsten Burhop, David Chambers, Ton de Graaf, Marc Deloof, Joost Jonker, Christopher Meissner (the editor), Peter Roosenboom, two anonymous reviewers, and the participants of the Economic History Society Annual Conference (University of York) and the Eurhistock Conference (University of Antwerp) for their comments and discussions.

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