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Do Firms Issue More Equity When Markets Become More Liquid? The Case of Imperial Germany, 1898–1913

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Abstract: Based on new aggregated data on initial and seasoned equity offerings (IPOs and SEOs) on the Berlin Stock Exchange before the First World War on a monthly basis and in combination with several other available datasets, we test the hypothesis presented by Hanselaar, René Stulz, and Mathijs (2019. Do Firms Issue More Equity when Markets Become More Liquid? *Journal of Financial Economics* 133 (1): 64–82) that market liquidity significantly influences issuance activity on the stock market. For the first time, we can substantiate this hypothesis using historical data. Indeed, the number and value of SEOs and IPOs can be explained quite well with the help of past market liquidity.

Keywords: financial history; Germany pre-1913; stock issues; market liquidity

JEL Classification: N23; G12

1 Introduction

Hanselaar, Stulz, and van Dijk (2019) ‘show that changes in equity issuance are positively related to lagged changes in aggregate [...] stock market liquidity’. While they base their finding on ‘quarterly data on initial public offerings (IPOs) and seasoned equity offerings (SEOs) for 37 countries from 1995 to 2014’, we use monthly data from the German Empire for the years 1898–1913 to investigate the association between market liquidity and issuing activity at the Berlin Stock Exchange. Hence, we provide the first ‘out of sample’ test of their key finding. In fact, we show that the

Correction statement: Correction added 03 June 2025 after online publication 23rd May 2025: in the original version the Lagged long-term interest rate-values 0,37 and 0,29 in table 5 and 0,89 and –1,36 in table 6 were mistakenly placed in row 1 and 2 instead of 2 and 3. Additionally, figures 4 and 5 had to be exchanged for reasons of unreadability.

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liquidity of the stock exchange has had a significant positive influence on issuance activity on the German capital market. Market liquidity was thus a factor that supporting the relatively large importance of the stock market for corporate finance in Germany compared to the present. Ever since the work by Rajan and Zingales (2003), scholars want to understand the great reversal of financial development. In a global perspective, financial markets were pretty well developed before World War I, followed by a decline and a reemergence of financial markets after c. 1970. According to Rajan and Zingales (2003, 14), the stock market capitalization to GDP ratio has been 0.44 in Germany in 1913. Data points from 1929 to 1990 show lower stock market development in Germany. Understanding why the German stock market has been well-developed before World War I may help to understand stock market development in the second millennium.

The financial economics literature contains numerous theoretical arguments and substantial empirical evidence for a close association between liquidity and share issues at the level of individual firms. For example, it is well-known that more liquid stocks have lower expected returns and thus higher price levels (Amihud and Mendelson 1986), making it for entrepreneurs and managers more attractive to sell equity stakes.

Beyond the firm-level, market-wide developments have been identified as significant driving forces of issuing activity. In particular, the liquidity of individual stocks is positively correlated to the trading activity on the entire securities market (Chordia et al. 2000). This association is higher in emerging compared to developed markets and it tends to move downwards in both groups of countries over time (Karolyi et al. 2012). We can thus expect a strong association between aggregate liquidity and the liquidity of individual stocks in a less developed, historical capital market. Beyond corporate finance aspects, we note substantial evidence that market liquidity is a key force behind the positive impact of stock market development on economic performance, e.g. economic growth, net investment, and rising total factor productivity (Levine and Zervos 1998; Rousseau and Wachtel 2000; Naes et al. 2011).

So far, the association between market liquidity and issuing activity has never been investigated in a historical setting. Yet, in a number of articles, underpricing and performance of IPOs and SEOs in Germany before World War I has been examined (e.g. Burhop 2010; Fohlin 2010; Lehmann 2014). In contrast, determinants of the number and total value of equity issues have not been evaluated. However, recent historical evidence for Belgium and the Netherlands could guide historical research based on German data. Deloof et al. (2023) analyse the variation in the number of IPOs in Belgium between 1839 and 1935. Economic growth, stock price levels, and stock market returns in year t positively affected the number and volume of IPOs during year $t + 1$. In contrast, stock price volatility, short-term interest rates and the steepness of the yield curve did not systematically affect IPO activity. In addition, De Jong and Legierse (2023) evaluate the Dutch IPO market between 1876 and 2015, focussing on hot markets. The number of IPOs at the Dutch capital market

is systematically related to past GDP growth, past stock market returns (positive correlation) and past stock market volatility (negative correlation). Long-term interest rates and the steepness of the yield curve did not affect the number of IPOs. Based on these results, we expect a positive impact of stock market returns, but no effect of interest rates on the number of IPOs in Germany. Moreover, we note that neither Deloof et al. (2023) nor De Jong and Legierse (2023) use market liquidity as an explanatory variable and that the authors do not investigate SEOs. Thus, our paper makes a relevant contribution to the economic history literature in two respects: we add Germany and SEOs to the objects of investigation.

The remaining parts of our paper are organized as follows: In Section 2, we discuss the data sources and plot key data. The baseline estimation results are presented in Section 3, various stability checks and extensions in Section 4. Section 5 concludes the paper.

2 Historical Background and Data Sources

The 15 years preceding World War I were a period of sustained economic growth in Germany. On average, real national product grew 2.6 percent annually between 1898 and 1913, prices were stable, and profits in the industrial sector sound. However, growth slowed down substantially during recessions in 1901/2, and 1907/8 (Burhop and Wolff 2005, 646, 650–652). The ups and downs of the real economy are reflected in stock market data. Annual returns for a broad sample of German stocks have been calculated by Eube (1998). According to the total returns (‘performance’) index, stock market returns averaged 5.9 percent per year between 1898 and 1913. While returns were positive most of the time, we note negative performances in 1900/01, and 1907.

The stock market played an important role financing economic growth during this period. In 1913, 922 firms (or 13.8 per million inhabitants) were listed at the Berlin Stock Exchange. In addition, 657 – mostly smaller firms – were only listed at one of Germany’s regional stock exchanges (Burhop and Lehmann-Hasemeyer 2016). Thus, 1,579 firms (23.6 per million inhabitants) were listed in Germany in 1913. Most recently, in 2022, only 429 firms (5.1 per million inhabitants) were listed.¹ The time series of the market value of shares newly issued by German corporations at German stock exchanges compared to the change of loan volumes of credit and mortgage banks (Figure 1) demonstrates the growing volume of financial intermediation as well as the relevance of market finance.

The number and value (at offering prices) of all IPOs and SEOs has been published in the *Vierteljahreshefte zur Statistik des Deutschen Reich*. The IPO data from

1 <https://data.worldbank.org/indicator/CM.MKT.LDOM.NO?view=chart&locations=DE>.

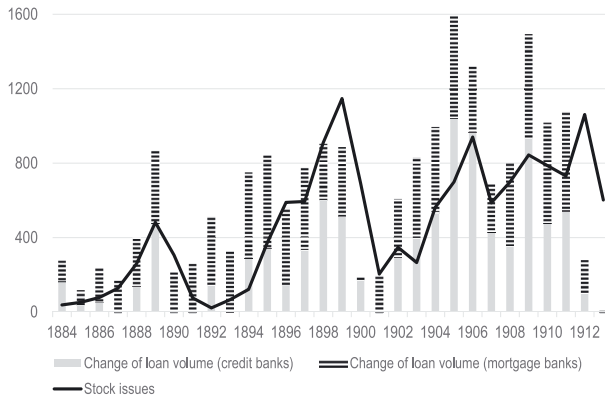


Figure 1: Change of loan volume of credit and mortgage banks and market value of stocks issued by German corporations at German stock exchanges. In million Mark, current prices. Source: Deutsche Bundesbank (1976, 56, 60–61, 293).

this source have already been used by Lehmann (2014). In addition, and for the first time, we employ information on 1,393 SEOs issued at the Berlin Stock Exchange between January 1898 and December 1913.

From a legal-institutional perspective, going public or issuing additional shares has been rather straightforward in Germany around 1900. The admission process consisted of five stages: after submission of the prospectus to the Exchange Admission Authority (Börsenzulassungsstelle), the application was published and reviewed by the rapporteur of the Admission Office. Then, the Admission Authority, which usually met twice a week, issued a decision and published the prospectus – most of the time less than one page in a newspaper. Subsequently, the securities had to be actually issued after six days at the earliest and after three months at the latest (Burhop 2015, 41–42; Gehlen 2018, 52, 60). For a sample of SEOs and IPOs in our database, we were able to calculate the number of days between the decision of the Exchange Admission Authority and the first trading day of the new security: on average, 17.3 days (18.2 days) passed between the two events in case of an SEO (IPO).²

Market timing played a role for contemporary writers when dealing with share issues. The timing depended on general demand on the securities market: new shares were to be issued when demand was high (Wolff 1915, 249). If necessary, the banks could increase market liquidity, for example by granting cheap loans to investors (Prion 1910, 40, 116). In addition, the money and stock market conditions were considered relevant. Low interest rates on the money market, reflected in the Privatdiskontsatz, and high returns on the stock market were regarded as

² Standard deviation of 15 days (SEOs) and 21 days (IPOs), respectively.

advantageous (Prion 1910, 111; Moral 1914, 53; Obst 1921, 509–510). Modern business history provides some more detailed evidence. Information provided by Burhop (2013) allows an evaluation of the potential association between liquidity and issue activity. In case of the IPO of the food firm Thörl, it took almost exactly 2 months between the decision to carry out the IPO and the start of stock exchange trading. Timing and pricing have been influenced by market liquidity. In case of the Harburger Eisen- und Broncewerke in November and December 1912, the low market liquidity was cited as the reason for the sluggish course of the issue. In case of Farbwerke Rasquin, the lead-underwriter took 3 months to prepare the issue (valuation of the firm, writing the prospectus, dealing with co-underwriters and the issuer). After settlement of all conflicts, the issue took place in Berlin 2 months later. In case of the IPO of Hubertus Braunkohlen, the preparatory work of the lead-underwriter took around 5 weeks. Ten weeks then passed before the IPO in Berlin. Thus, the duration of the process was short, but variable.

On average, the offering value of an IPO has been 5.6 million Mark, whereas the offering value of an SEO has been 6.7 million Mark.³ The following Figures 2 and 3 show the number and value of IPOs and SEOs during 1898–1913. On average, about two firms went public during each month and seven firms raised additional equity capital. If one relates this to the number of companies listed in Berlin, this means that each year nearly 15 percent of the listed companies carried out a capital increase, which is a very large ratio compared, for example, to the USA in the years 1973–2001, where only three and a half percent of the listed companies carried out a capital increase in a given year (DeAngelo et al. 2010, 279).⁴ Obviously, the number and value of issues fluctuates over time. For example, the economic and stock market crises of 1901/02 and 1907/08 are visible in the IPO and SEO data.

Estimates of three measures of trading costs and three indicators of trading volume on the Berlin Stock Exchange on a monthly frequency have recently been published by Burhop and Gelman (2022). We prefer trading volume indicators since trading costs indicators were unavailable to (not calculated by) decision makers in 1900. Our preferred measure of market liquidity is trading volume proxied by monthly German stamp tax data. Stamp tax data have been published on a monthly frequency and with a delay of around one month – i.e. August data were published in late September – in the relevant newspapers (e.g. the *Berliner Börsenzeitung*). This series starts in January 1895. Burhop and Gelman (2022) provide two alternative series proxying trading volume: stamp tax data from the tax office located in the Berlin Stock Exchange (available from January 1903 onwards) and clearing data of

3 Holding gold coins (cash) has been a risk-free investment alternative around 1900. At official prices, one million Mark equalled 359.2 kg Gold. Today, this amount of gold has a value of around 30 million €.

4 In 2022–23, 5.8 percent of the firms listed at the Frankfurt Stock Exchange conducted an SEO.

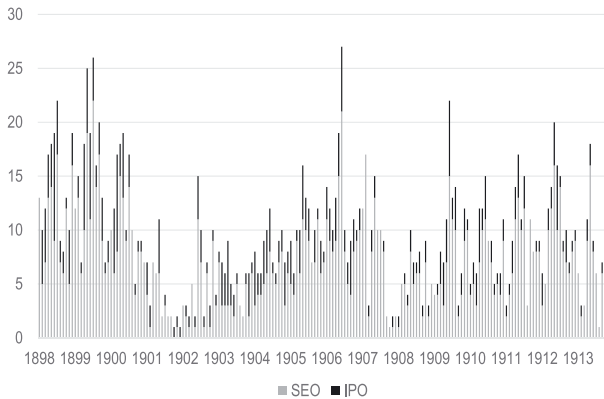


Figure 2: Number of SEOs and IPOs at Berlin Stock Exchange, 1898–1913 (monthly data). Source: Kaiserliches Statistisches Amt (1899–1914); own calculations.

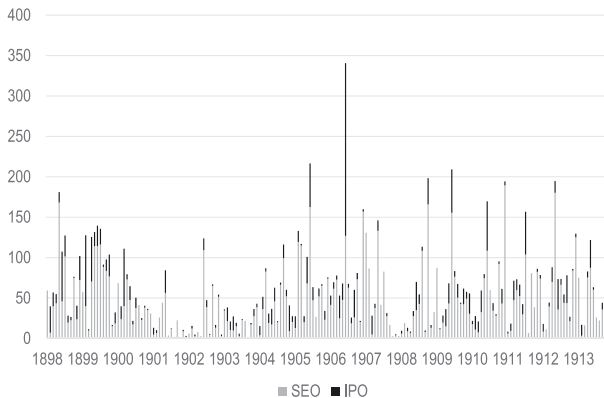


Figure 3: Value (in Million Mark) of SEOs and IPOs at Berlin Stock Exchange, 1898–1913 (monthly data). Source: Kaiserliches Statistisches Amt (1899–1914); own calculations.

the Bank des Berliner Kassenvereins, the clearing house of the Berlin Stock Exchange (available from January 1902 onwards). ‘Banks located in Berlin regularly had an account with the Kassenverein in order to settle the net amounts accruing from securities transactions at the end of the month. During the course of the month, each bank was credited with the incoming payments from the sale of securities, outgoing payments for purchases of securities were debited from the account and the accounts had to be balanced at the end of the month. Contemporary authors and interest groups have already used these figures to approximate stock market trading volume’ (Burhop and Gelman 2022, 30). With respect to stamp tax data, we want to clarify that the stamps on broker notes were taxable and that broker could deal in

stocks, bonds and commodities. Moreover, stamp tax data regularly refer to Germany, not to individual stock exchanges. Thus, stamp tax data reflect financial market liquidity, not only stock market liquidity.

Furthermore, we note that two types of stamp taxes potentially affected the association between market liquidity and share issues: a transaction tax (used by Burhop and Gelman) and an issue tax. At the beginning of our investigation period, transactions were taxed at 0.02 percent of the market value. From 1 July 1900 onwards, transactions were taxed at 0.03 percent of the market value. Issuing of stocks has been taxed at one percent of the face value until 30 June 1900. Subsequently, the tax rate was doubled and the tax was now based on the issuing price. Later on, the tax rate for share issues has been increased to 3 percent (1 August 1909) and 4.5 percent (1 October 1913), respectively.

The 1900 tax reform thus potentially affected both sides of the regression: market liquidity via the increasing transaction tax, issuing activity via the increasing issue tax. A ‘1900 tax reform dummy’ – taking the value 1 from July 1900 until July 1909 – should thus be significantly negative. Moreover, a ‘1909 tax reform dummy’ – taking the value 1 from August 1909 – can be expected to have a negative sign, since issuing of stocks became more expensive.⁵

In addition, we include economic control variables: the private discount rate on the money market (Privatdiskontsatz; NBER Macroeconomy database series m13018) – the 3-month lending rate for low-risk commercial paper in Berlin – the government bond yield (NBER Macroeconomy database series m13018 and m13028a), the monthly return of Eube’s (1998) stock price index (‘Kursindex’) as well as the volatility of this index over the last 12 months. We do not include GDP growth since GDP data are only available on annual frequency. Information available on a monthly frequency reflecting the performance of the real economy have been collected by Grabas (1992). In particular, we include iron consumption, volume of imports and exports, railroad freight traffic, membership of health insurance and jobseekers per registered vacancy to calculate a macroeconomic development index (see appendix for details of the calculation and the resulting series). We also include a guesstimate of the aggregate market capitalization as our stock market development index (see appendix for details). All of the explanatory variables are lagged by 1 month, to reveal the information set available to company management prior to the IPO or SEO decision.

More specifically, we estimate – for all issues, only for SEOs and only for IPOs – variants of the following regressions:

$$\text{Issue - number}_t = \beta \cdot L_{t-1} + \gamma \cdot X_{t-1} + \varepsilon_t \quad (1)$$

5 Please note that listed and non-listed joint-stock companies had to pay the issue tax.

$$\text{Issue} - \text{value}_t = \beta \cdot L_{t-1} + \gamma \cdot X_{t-1} + \varepsilon_t \quad (2)$$

Our dependent variables are number of issues (all issues or only IPOs or only SEOs) in a given month or issues' proceeds (all issues or only IPOs or only SEOs) in a given month. Our key explanatory variable is denoted by L (market liquidity). We run the regressions for the total number of issues (total value) per month on the previous month liquidity and a growing number of controls. Given that equity placements may exhibit seasonality we use period dummies (with January being the base period).⁶ Moreover, we include a time trend variable to account for possible deterministic trends in the dependent and explanatory variables. To account for slow-moving determinants of the offering activity, we control for residual autocorrelation using Newey-West heteroscedasticity and autocorrelation consistent standard errors.

3 Baseline Results

We observe a statistically significant impact of lagged market liquidity on the number of issues in the regressions reported in Table 1. Moreover, the statistical and economic significance – reflected in the standardized coefficient – of market liquidity remains pretty similar when we include control variables in regressions 2 and 3. We include six control variables (stock index return, standard deviation of stock index return, short-term interest rate, long-term interest rate, macroeconomic index and stock market development index) in regression 2. Stock market returns and volatility of stock prices do not affect issuing activity. The impact of interest rates and macroeconomic developments are weak – and disappear in regression 3. Lagged stock market development has a significant impact on the number of issues.

In regression 3, we include tax regime dummies and the lagged depended variable. Tax regime 1 (the baseline regime) runs from January 1898 until June 1900, the second regime starts in July 1900 ('First tax reform') and ends in July 1909, when the final tax regime begins. Both dummies ('First tax reform', 'Second tax reform') are statistically significant and have a negative sign, i.e. higher tax rates on stock issues came along with lower issuing activity.

According to regression 3 in Table 1, a one standard deviation increase of tax receipts in Germany during month $t - 1$ leads to an increase of the number of issues by 0.314 standard deviations in month t . Or in economic terms: A change of turnover tax revenues in month $t - 1$ by about 0.5 million Mark is associated to 1.6 more issues in month t . We observe a rise (fall) in tax revenue of this scale 15 (10) times in our data

⁶ Gehlen (2018: 53) shows that most admission decisions were made in June, May and April.

Table 1: Impact of liquidity on number of issues.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	4.36*** (0.73) [0.413]	2.81** (0.90) [0.267]	3.30** (0.85) [0.314]
Lagged stock index return		14.16 (16.36)	4.02 (14.06)
Lagged standard deviation of stock index return		−0.22 (0.16)	0.00 (0.15)
Lagged short-term interest rate		115.00* (55.34) [0.232]	72.08 (50.71)
Lagged long-term interest rate		−1,259.35* (604.28) [−0.398]	−982.49 (502.11)
Lagged macroeconomic index		2.72* (1.32) [0.522]	1.20 (1.15)
Lagged stock market development index		0.64** (0.19) [1.126]	0.62* (0.31) [1.094]
First tax reform			−4.26* (2.14)
Second tax reform			−8.62** (2.45)
Lagged dependent			0.14* (0.07)
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.325	0.486	0.548
Number of observations	191	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

set. In addition, we note that higher taxes lead to declining issuing activity. Moreover, explanatory variables reflecting the current financial market situation (stock index returns, volatility of stock index returns, short- and long-term interest rates) and the macroeconomy are insignificant. In contrast, the level of lagged stock market development has a significant – in statistical and economic perspective – impact on the number of issues. Thus, stock market development in Germany around 1900 has been a self-reinforcing process: a higher level of stock market development induces a

stronger issuing activity, thereby increasing stock market development. However, market liquidity has been an additional force driving issuing activity.

Furthermore, we note the substantial explanatory power of our regressions. The adjusted R^2 of regression 3 is, for example, 0.548. Thus, we explain more than half of the variation of issuing activities at the German stock market by our model. Thereby the marginal R^2 contribution of adding lagged turnover tax receipts to a regression is 0.117 in regression 1 and 0.033 in regression 3 (not reported in Table 1).

We now turn to the impact of market liquidity on the total proceeds (Table 2). Hanselaar, René Stulz, and Mathijs (2019: 77–78) use proceeds only in some control regressions since proceeds can be noisy and driven by few large issues. Indeed, the adjusted R^2 of the three models reported in Table 2 is much lower than the values reported in Table 1. The marginal R^2 contribution of adding lagged turnover tax receipts to a regression is 0.064 in regression 1 and 0.040 in regression 3 (not reported in Table 2). Nevertheless, market liquidity is statistically significant on all three regressions. An increase of tax receipts by about 0.5 million Mark in month $t - 1$ leads to an increase of total proceeds in month t of about 16 million Mark (0.336 standard deviations).⁷ The regression coefficients of the six economic control variables are insignificant. Moreover, the impact of tax reforms on proceeds is much weaker than the impact of tax reforms on the number of issues. Thus, our model explains the number of issues much better than total proceeds.

In Tables 3–6, we split the sample and use SEOs (IPOs) only. Lagged market liquidity is significant in all specifications. Our following interpretation of the economic significance bases on the third regression from each Tables 3–6. An increase of tax receipts by 0.5 million Mark (one standard deviation) in month $t - 1$ leads to 1.3 more SEOs and to additional proceeds from SEOs of 11.1 million Mark in month t . In case of IPOs, an increase of tax receipts by 0.5 million Mark in month $t - 1$ leads to 0.5 additional IPOs in period t and additional IPO proceeds of 5.8 million Mark in month t . Furthermore, the first tax reform has a negative impact on the number of IPOs. The second tax reform has, in contrast, a significantly negative impact on all four dependent variables (number and proceeds of SEOs and IPOs). The six economic control variables affect neither SEO nor IPO proceeds. Turning to the number of SEOs and IPOs, we find only one effect – a positive association between long-term interest rates and the number of SEOs. Finally, taking adjusted R^2 as an

⁷ The average issue size (SEOs and IPOs combined) has been around 6 million Mark. A one standard deviation increase of liquidity leads to 1.6 additional issues – reflecting a market value of about 10 million Mark. Thus, our findings regarding total proceeds suggest an additional effect – valuations could be higher during periods of high liquidity and / or larger issues were floated in times of high liquidity.

Table 2: Impact of liquidity on total proceeds.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	30.77*** (7.29) [0.304]	24.64** (8.68) [0.244]	34.00*** (9.86) [0.336]
Lagged stock index return		155.69 (198.85)	47.72 (180.52)
Lagged standard deviation of stock index return		-2.58 (1.85)	-0.37 (1.78)
Lagged short-term interest rate		471.22 (639.36)	166.37 (612.22)
Lagged long-term interest rate		-7,534.83 (5,617.77)	-7,168.39 (5,289.14)
Lagged macroeconomic index		14.84 (17.71)	5.97 (17.05)
Lagged stock market development index		1.80 (2.07)	3.85 (4.15)
First tax reform			-43.41 (22.04)
Second tax reform			-96.52*** (28.07)
Lagged dependent			[-0.868] -0.04 (0.08)
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.163	0.193	0.237
Number of observations	191	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

indicator, our model works much better when we employ number of issues as dependent variable.

4 Extensions and Stability

So far, we used stamp tax receipts from securities market transactions in Germany as our key proxy of market liquidity at the Berlin Stock Exchange. In Tables 7 and 8, we demonstrate that our key result – a significant and relevant impact of market liquidity on issue activity – holds, when we use two alternative and observable (to

Table 3: Impact of liquidity on number of SEOs.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	3.22*** (0.62) [0.374]	2.16** (0.75) [0.251]	2.62*** (0.77) [0.304]
Lagged stock index return		−0.19 (14.69)	−7.78 (13.23)
Lagged standard deviation of stock index return		−0.12 (0.14)	0.05 (0.14)
Lagged short-term interest rate		117.28* (52.07) [0.289]	89.15 (46.85)
Lagged long-term interest rate		−965.34* (465.32) [−0.373]	−860.27* (407.85) [−0.332]
Lagged macroeconomic index		2.35* (1.10) [0.551]	1.22 (1.01)
Lagged stock market development index		0.64** (0.19) [1.096]	0.62* (0.31) [1.462]
First tax reform			−2.56 (1.71)
Second tax reform			−6.65** (2.04) [−0.701]
Lagged dependent			0.10 (0.08)
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.238	0.418	0.462
Number of observations	191	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

market participants around 1900) measures of market liquidity. In contrast, liquidity indicators developed by modern scholars and retrospectively calculated by economic historians did not affect the behaviour of market participants around 1900. Our first alternative is transaction volumes published by the clearing house of the Berlin Stock Exchange, the Kassenverein. Our second alternative is securities market turnover taxes collected at the tax office of the Berlin Stock Exchange

Table 4: Impact of liquidity on SEO proceeds.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	21.11** (6.58) [0.259]	16.31* (7.42) [0.200]	22.45** (7.91) [0.276]
Lagged stock index return		32.02 (187.97)	−56.97 (173.10)
Lagged standard deviation of stock index return		−1.79 (1.69)	−0.13 (1.61)
Lagged short-term interest rate		266.42 (596.33)	78.39 (583.63)
Lagged long-term interest rate		−5,249.03 (4,876.41)	−4,865.12 (4,710.26)
Lagged macroeconomic index		13.95 (16.60)	4.82 (16.42)
Lagged stock market development index		1.80 (2.07)	3.85 (4.15)
First tax reform			−28.69 (19.09)
Second tax reform			−68.45*** (22.08) [−0.765]
Lagged dependent			0.03 (0.09)
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.109	0.126	0.161
Number of observations	191	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

(Finanzamt Börse). These two alternative liquidity data are, unfortunately, not available for the full sample period. Kassenverein data start in January 1902, Berlin tax data in January 1903. Thus, we lose 4, respectively 5, years of data. To make results comparable, we use identical sample periods and specifications in the following two tables. Available for the entire investigation period are the two modern indicators of market liquidity: The fraction of zero return days and roundtrip transaction cost ('LOT-measure').

The results reported in Tables 7 and 8 demonstrate that the choice of market liquidity proxy does not affect our key result – if we use liquidity measures available to investors around 1900. Only the size of the standardized coefficients varies slightly.

Table 5: Impact of liquidity on number of IPOs.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	1.13** (0.24) [0.296]	0.65* (0.31) [0.169]	0.93** (0.30) [0.242]
Lagged stock index return		14.35 (9.05)	11.98 (8.95)
Lagged standard deviation of stock index return		−0.10 (0.07)	−0.04 (0.07)
Lagged short-term interest rate		−2.27 (20.05)	−19.58 (22.31)
Lagged long-term interest rate		−294.01 (262.60)	−168.16 (238.40)
Lagged macroeconomic index		0.37 (0.64)	0.29 (0.64)
Lagged stock market development index		0.13 (0.08)	−0.05 (0.15)
First tax reform			−2.24** (0.78) [−0.587]
Second tax reform			−2.69** (0.80) [−0.639]
Lagged dependent			0.00 (0.07)
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.278	0.320	0.356
Number of observations	191	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

Kassenverein data show a comparatively strong impact of liquidity on the number of issues (total proceeds), whereas Berlin tax data show a slightly lower economic significance of market liquidity. In contrast, liquidity measures based on more recent propositions from the empirical finance literature – like LOT or zero returns – are not systematically related to issuing activity. Yet, these measures were neither observed nor debated by decision makers around 1900 and we thus do not expect an impact.

So far, we included only the first lag of market liquidity into our regression model and evaluated only the short-run impact of liquidity on issuing activity. In

Table 6: Impact of liquidity on IPO proceeds.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	9.66*** (2.20) [0.233]	8.34* (3.53) [0.201]	11.82** (4.11) [0.285]
Lagged stock index return		123.67 (63.92)	100.16 (64.79)
Lagged standard deviation of stock index return		−0.79 (0.64)	−0.25 (0.60)
Lagged short-term interest rate		204.80 (165.90)	123.63 (185.50)
Lagged long-term interest rate		−2,285.80 (1785.35)	−2,238.94 (2026.11)
		0.89 (5.20)	−1.36 (4.84)
Lagged financial development		0.31 (0.86)	0.52 (1.45)
First tax reform			−13.78 (8.45)
Second tax reform			−26.91*** (7.78)
Lagged dependent			[−0.590] −0.13 (0.07)
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.156	0.159	0.179
Number of observations	191	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

Table 9, lagged turnover tax (for up to 4 months) and cumulative number of issues and issue proceeds (for up to 4 months) are included. In view of the results presented in Table 9, including only the first lag of turnover taxes into the regression seems to be a sensible choice. Furthermore, we observe a long-term effect of past turnover tax receipts on the number of issues and proceeds. However, the regression coefficients barely grow when more periods are included. Thus, higher turnover tax receipts during period $t - 1$ have an impact on issuing activity (number and value) up to period $t + 3$, but most of the effect occurs during periods t and $t + 1$, hence in the 2-month window subsequent to the liquidity shock.

Table 7: Impact of liquidity on number of issues – alternative measures.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lagged turnover tax (Germany)	2.78** (0.90) [0.327]		3.03** (1.01) [0.366]				
Lagged Kassenverein clearing		0.004* (0.00) [0.343]		0.005* (0.002) [0.375]			
Lagged turnover tax (Berlin)					3.12** (1.13) [0.261]		
Lagged LOT						–19.32 (206.99)	
Lagged proportion of zero returns							–17.13 (9.45)
Economic control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax regime dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged depended variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.439	0.421	0.435	0.425	0.429	0.505	0.513
Number of observations	144	143	132	132	131	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

Our VAR (see Figures 4 and 5) support this finding.⁸ Turnover taxes have an impact on issuing activity. Figure 4 (Figure 5) displays the impact of turnover tax receipts on the number (value) of issues. The upper-left panels show a clearly significant impact of turnover tax receipts on the number (value) of issues after a few periods without much increase later on.⁹

Finally, we vary the econometric method and take care of the fact that the number of issues is a count variable (see Table 10). Thereby we keep the same

⁸ See also Table A1 in the Appendix for VAR(2) coefficients and further statistics.

⁹ Cumulative response seems to grow noticeably up to the period $t + 6$; however, the confidence intervals for cumulative responses up to $t + 1$ and up to $t + 6$ overlap, so we cannot claim significant difference between them, and hence the overall picture seems to be in line with our findings in Table 9. See also Table A2 in the Appendix for a similar pattern in results on longer-term cumulated issuance effects.

Table 8: Impact of liquidity on proceeds – alternative measures.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Lagged turnover tax (Germany)	37.06** (12.19) [0.380]		44.23** (14.04) [0.456]				
Lagged Kassenverein clearing		0.07** (0.02) [0.493]		0.08** (0.03) [0.539]			
Lagged turnover tax (Berlin)					55.04** (15.79) [0.394]		
Lagged LOT						–3,185.48 (2041.26) [–0.120]	
Lagged proportion of zero returns							–188.20 (114.92) [–0.135]
Economic control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Tax regime dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged depended variable	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.206	0.197	0.172	0.167	0.166	0.199	0.202
Number of observations	144	143	132	132	131	191	191

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

controls as in the specification of column 3, Table 1. The results of a negative binomial and of a Poisson regression support our key result: lagged liquidity has a positive impact on the number of equity issues.

5 Conclusions

In this paper, we have examined the relationship between financial market liquidity and stock issues on the basis of historical data and found that greater market

Table 9: Cumulative issuance (number and proceeds).

Accumulated dependent	(1) Number $t:t + 1$	(2) Number $t:t + 2$	(3) Number $t:t + 3$	(4) Proceeds $t:t + 1$	(5) Proceeds $t:t + 2$	(6) Proceeds $t:t + 3$
Turnover tax $t - 1$	5.54** (1.55)	6.13** (2.11)	6.12* (2.75)	58.10** (18.83)	57.03** (20.64)	68.58** (22.41)
Turnover tax $t - 2$	0.39 (1.46)	0.35 (1.81)	-0.25 (1.99)	14.16 (21.21)	19.94 (20.52)	22.71 (19.15)
Turnover tax $t - 3$		0.25 (2.09)	0.81 (2.05)		20.61 (16.44)	-0.37 (20.80)
Turnover tax $t - 4$			-0.66 (2.26)			15.76 (21.54)
Dep $t - 1$	0.20 (0.10)	0.17 (0.14)	0.18 (0.18)	-0.11 (0.10)	-0.16 (0.12)	-0.11 (0.14)
Dep $t - 2$	0.13 (0.10)	0.16 (0.15)	0.24 (0.19)	-0.07 (0.09)	-0.05 (0.12)	-0.05 (0.13)
Dep $t - 3$		0.16 (0.16)	0.13 (0.16)		-0.01 (0.10)	0.01 (0.12)
Dep $t - 4$			0.35* (0.15)			0.14 (0.13)
Economic controls	Y	Y	Y	Y	Y	Y
Tax regime dummies	Y	Y	Y	Y	Y	Y
Constant	Y	Y	Y	Y	Y	Y
Time trend	Y	Y	Y	Y	Y	Y
Month dum.	Y	Y	Y	Y	Y	Y
Observations	190	189	188	190	189	188
R-sq	0.73	0.77	0.79	0.50	0.58	0.61

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

liquidity leads to greater issuance activity with a lag of 1 month. This is the first time that the main result of Hanselaar, Stulz, and van Dijk (2019) has been replicated using historical data. In addition to this contribution to financial economics as well as economic history, our article contributes three new perspectives. First, we look at initial public offerings (IPOs) and seasoned equity offerings (SEOs), while the present literature, which is dedicated to German or international financial market history, looks almost exclusively at IPOs. Second, we indirectly contribute an international comparative perspective. So far, variations in the number of IPOs have only been examined for Belgium and the Netherlands. We now add Germany as a third case. In contrast to Belgium and the Netherlands, we do not find any influence of equity market performance or the volatility of equity prices on issuance activity in

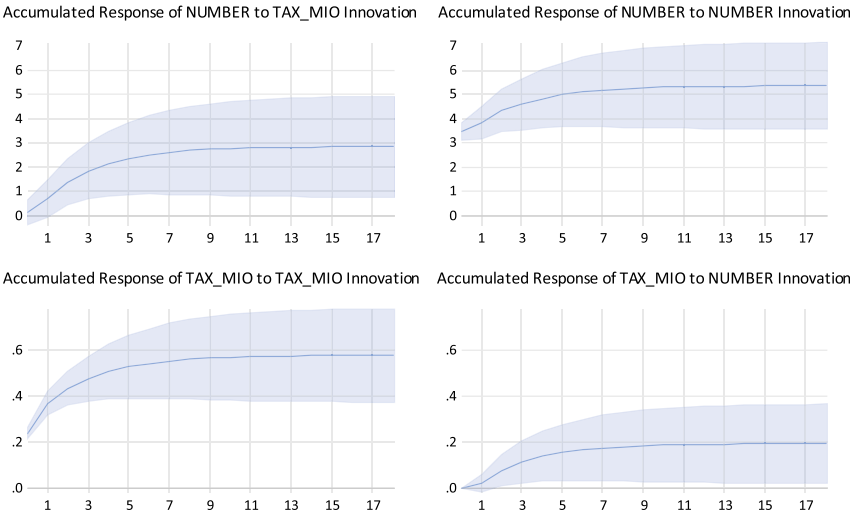


Figure 4: Cholesky-order: tax > number.

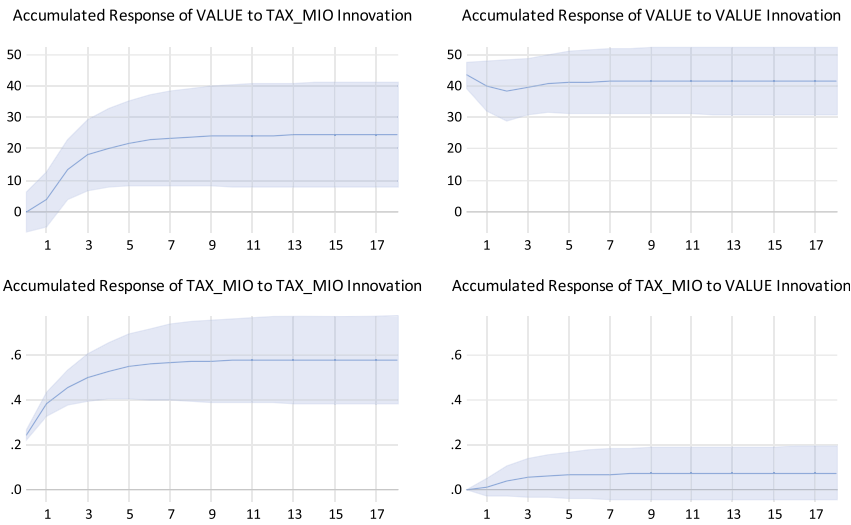


Figure 5: Cholesky-order: tax > value.

Germany. Third, our dataset is partly based on newly collected data. We collected data on SEOs in Germany between January 1898 and December 1913 for the first time. We combine this new data with existing data on IPOs (Lehmann 2014), market

Table 10: Impact of liquidity on number of issues – alternative methods.

	(1) Poisson regression	(2) Negative binomial regression
Turnover tax Germany ($t - 1$)	0.37*** (0.08)	0.37*** (0.09)
Economic control variables	Yes	Yes
Tax regime dummies	Yes	Yes
Constant	Yes	Yes
Time trend	Yes	Yes
Month dummy	Yes	Yes
Lagged depended variable	Yes	Yes
LR statistics	319.87	321.12
Prob (LR statistics)	0.000	0.000
Pseudo- R^2	0.619	0.618
Number of observations	191	191

All controls are lagged 1 month. Standard errors reported in brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

liquidity (Burhop and Gelman 2022), equity market returns (Eube 1998) and interest rates (NBER Macrohistory database series m13018 and m13028a). Moreover, we include new guesstimates of macroeconomic and stock market development.

On the basis of these data, we can once again demonstrate the relative importance of capital market-based financing in Wilhelmine Germany and illustrate its connection with the general economic and financial market development. The issuance data, aggregated on a monthly basis, show a close, positive correlation with the previous month's market liquidity. Neither short-term and long-term interest rates nor price increases or price fluctuations on the stock market have a significant influence on the number and value of issues. Higher taxes on securities issues and securities trading tend to lead to a decline in issuance activity. Overall, we can explain the number of issues better than the aggregated proceeds. Nevertheless, proceeds also depend significantly and positively on the market liquidity of the previous period. Finally, we notice that our model can explain capital increases slightly better than initial share issues. This could indicate that asymmetric information – which is likely to be more pronounced in IPOs than in SEOs – weakens the association between market liquidity and issuance activity.

Appendix: Variable Definitions

Macroeconomic Index. We construct our business cycle index (or macroeconomic index) as the first principal component of the following six indicators: iron

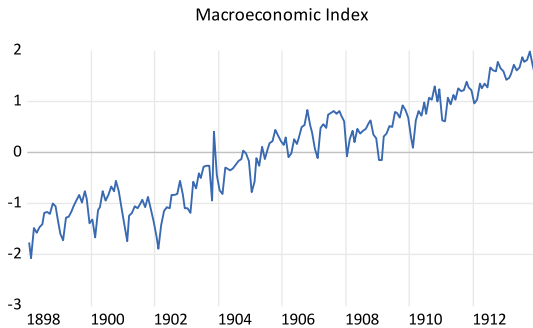


Figure A1: Macroeconomic index.

consumption, volume of imports and exports, railroad freight traffic, membership of health insurance and jobseekers per registered vacancy. We take natural logarithm of the first five indicators prior to running principal component analysis. The principal component analysis yields for our index the following formula:

$MI_t = 0.456 \cdot \text{Iron}_t + 0.448 \cdot \text{Export}_t + 0.428 \cdot \text{Import}_t + 0.440 \cdot \text{Health}_t + 0.456 \cdot \text{Freight}_t - 0.082 \cdot \text{Seekers}_t$, where *Iron*, *Export*, *Import*, *Health* and *Freight* denote standardized values of logarithms of iron consumption, volume of exports and imports, railroad freight traffic and membership of health insurance, correspondingly. *Seekers* represents standardized number of jobseekers per registered vacancy.¹⁰ Finally, we standardize the index to have a unit standard deviation. We present a graph of the resulting variable in Figure A1.

Stock market development index. We construct our stock market development index as a guesstimate of the aggregate market capitalization, namely first multiplying the number of companies included by Eube in his stock market index by the value of the Eube index and subsequently calibrating it to match the known stock market aggregate capitalization in December 1900.¹¹ This measure would exactly match aggregate market capitalization if all firms were the same size. Even though in reality sizes of listed firms differed, given the data availability, our measure provides a reasonable approximation.

¹⁰ Note that all the coefficients have expected signs. E.g., in a growing economy one would expect iron consumption, railroad freight traffic, exports and imports to increase, more people would be able to afford medical insurance, whereas the number of jobseekers per vacancy would go down.

¹¹ Note, that the number of companies observed by Eube is available on the annual frequency, whereas Eube index is available on the monthly frequency, which may lead to some discontinuity of our measure at the turn of the year. However, since in all our regression specifications we include monthly dummies, this discontinuity should be absorbed by these dummies and not affect our results.

Appendix: Further Results

See Tables A1–A4.

Table A1: VAR (2); turnover tax, number of issues and proceeds.

Dependent	Number t	Tax t	Value t	Tax t
Turnover tax $t - 1$	2.28* (1.10)	0.54*** (0.08)	16.33 (13.59)	0.56*** (0.08)
Turnover tax $t - 2$	1.27 (1.15)	−0.04 (0.08)	31.02* (14.36)	−0.02 (0.08)
Issuance $v t - 1$	0.10 (0.08)	0.01 (0.01)	−0.08 (0.08)	0.00 (0.00)
Issuance $v t - 2$	0.12 (0.08)	0.01* (0.01)	−0.04 (0.08)	0.00 (0.00)
Economic controls	Y	Y	Y	Y
Tax regime dummies	Y	Y	Y	Y
Constant	Y	Y	Y	Y
Time trend	Y	Y	Y	Y
Month dum.	Y	Y	Y	Y
Observations	190	190	190	190

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

Table A2: Cumulative issuance, increase in cumulation horizon.

Accumulated dependent	(1) Number $t:t + 1$	(2) Number $t:t + 2$	(3) Number $t:t + 3$	(4) Number $t:t + 5$	(5) Number $t:t + 8$	(6) Number $t:t + 11$
Turnover tax $t - 1$	6.24*** (1.57) [0.334]	7.50*** (2.15) [0.286]	8.14** (2.98) [0.248]	10.04* (4.27) [0.224]	13.29* (5.18) [0.217]	13.74 (7.04)
Dep $t - 1$	0.23* (0.11) [0.127]	0.24 (0.14)	0.28 (0.19)	0.45 (0.26)	0.45 (0.30)	0.27 (0.36)
Economic controls	Y	Y	Y	Y	Y	Y
Tax regime dummies	Y	Y	Y	Y	Y	Y
Tax interaction terms	N	N	N	N	N	N
Constant	Y	Y	Y	Y	Y	Y
Time trend	Y	Y	Y	Y	Y	Y
Month dum.	Y	Y	Y	Y	Y	Y

Table A2: (continued)

Accumulated dependent	(1) Number <i>t:t + 1</i>	(2) Number <i>t:t + 2</i>	(3) Number <i>t:t + 3</i>	(4) Number <i>t:t + 5</i>	(5) Number <i>t:t + 8</i>	(6) Number <i>t:t + 11</i>
Observations	190	189	188	186	183	180
<i>R</i> -sq	0.73	0.77	0.79	0.50	0.58	0.84
Accumulated dependent	(1) Value <i>t:t + 1</i>	(2) Value <i>t:t + 2</i>	(3) Value <i>t:t + 3</i>	(4) Value <i>t:t + 5</i>	(5) Value <i>t:t + 8</i>	(6) Value <i>t:t + 11</i>
Turnover tax <i>t</i> – 1	66.44*** (18.60) [0.424]	74.01** (23.04) [0.365]	83.94** (27.51) [0.345]	92.62** (33.50) [0.291]	120.46** (41.14) [0.277]	99.03 (57.73)
Dep <i>t</i> – 1	–0.09 (0.09)	–0.10 (0.10)	–0.08 (0.13)	–0.04 (0.15)	–0.01 (0.18)	–0.13 (0.26)
Economic controls	Y	Y	Y	Y	Y	Y
Tax regime dummies	Y	Y	Y	Y	Y	Y
Tax interaction terms	N	N	N	N	N	N
Constant	Y	Y	Y	Y	Y	Y
Time trend	Y	Y	Y	Y	Y	Y
Month dum.	Y	Y	Y	Y	Y	Y
Observations	190	189	188	186	183	180
<i>R</i> -sq	0.48	0.54	0.60	0.64	0.66	0.67

All controls are lagged 1 month. Newey-West (1987) heteroscedasticity and autocorrelation consistent standard errors. Standard errors reported in brackets. Standardized coefficients of significant variables are reported in square brackets. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

Table A3: Impact of liquidity on number of issues, standardized coefficients.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	0.413***	0.267**	0.314**
Lagged stock index return		0.045	0.013
Lagged standard deviation of stock index return		–0.085	0.001
Lagged short-term interest rate		0.232*	0.145
Lagged long-term interest rate		–0.398*	–0.311
Lagged macroeconomic index		0.522*	0.230
Lagged stock market development index		1.126**	1.094*
First tax reform			–0.406*
Second tax reform			–0.744**
Lagged dependent			0.145*
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted <i>R</i> ²	0.325	0.486	0.548
Number of observations	191	191	191

All controls are lagged 1 month. The table reports standardized coefficients of the regressions as in Table 1. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

Table A4: Impact of liquidity on total proceeds, standardized coefficients.

	(1)	(2)	(3)
Lagged turnover tax (Germany)	0.304***	0.244**	0.336***
Lagged stock index return		0.052	0.016
Lagged standard deviation of stock index return		−0.106	−0.015
Lagged short-term interest rate		0.099	0.035
Lagged long-term interest rate		−0.248	−0.236
Lagged macroeconomic index		0.297	0.119
Lagged stock market development index		0.329	0.705
First tax reform			−0.432
Second tax reform			−0.868***
Lagged dependent			−0.040
Constant	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
Month dummy	Yes	Yes	Yes
Adjusted R^2	0.163	0.193	0.237
Number of observations	191	191	191

All controls are lagged 1 month. The table reports standardized coefficients of the regressions as in Table 2. Values marked with *, ** and *** are significant at 5 %, 1 % and 0.1 % level, respectively.

References

Amihud, Yakov, and Haim Mendelson. 1986. “Asset Pricing and the Bid-Ask Spread.” *Journal of Financial Economics* 17 (2): 223–49.

Burhop, Carsten. 2010. “The Underpricing of Initial Public Offerings at the Berlin Stock Exchange, 1870–96.” *German Economic Review* 12 (1): 11–32.

Burhop, Carsten. 2013. “Ressourcenkonflikte bei Aktienerstmissionen im Deutschen Reich um 1900.” *Bankhistorisches Archiv* 39 (1): 1–19.

Burhop, Carsten. 2015. “Regulierung und Selbstregulierung am Berliner Aktienmarkt.” *Zeitschrift für Neuere Rechtsgeschichte* 37 (1–2): 32–49.

Burhop, Carsten, and Sergey Gelman. 2022. “Trading Costs and Trading Quantity at the Berlin Stock Exchange, 1892–1913.” *Zeitschrift für Unternehmensgeschichte* 67 (1): 21–42.

Burhop, Carsten, and Sybille Lehmann-Hasemeyer. 2016. “The Berlin Stock Exchange and the Geography of German Stock Markets in 1913.” *European Review of Economic History* 20 (4): 429–51.

Burhop, Carsten, and Guntram B. Wolff. 2005. “A Compromise Estimate of German Net National Product, 1851–1913, and its Implications for Growth and the Business Cycle.” *The Journal of Economic History* 65 (3): 613–57.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam. 2000. “Commonality in Liquidity.” *Journal of Financial Economics* 56 (1): 3–28.

de Jong, Abe, and Wilco Legierse. 2023. “What Causes Hot Markets for Equity IPOs? an Analysis of Initial Public Offerings in the Netherlands, 1876–2015.” *European Review of Economic History* 26 (2): 208–33.

DeAngelo, Harry, Linda DeAngelo, and René M. Stulz. 2010. “Seasoned Equity Offerings, Market Timing, and the Corporate Lifecycle.” *Journal of Financial Economics* 95 (3): 275–95.

- Deloof, Marc, Abe de Jong, and Wilco Legierse. 2023. "Going Public: Evidence from Stock and Bond IPOs in Belgium, 1839–1935." *Cliometrica* 17 (3): 433–66.
- Deutsche Bundesbank. 1976. *Deutsches Geld- und Bankwesen in Zahlen, 1876–1975*. Frankfurt am Main: Fritz Knapp Verlag.
- Eube, Stefan. 1998. *Der Aktienmarkt in Deutschland vor dem Ersten Weltkrieg*. Frankfurt am Main: Fritz Knapp Verlag.
- Fohlin, Caroline. 2010. "Asymmetric Information, Market Power, and the Underpricing of New Stock Issues in Germany, 1882–1892." *The Journal of Economic History* 70 (3): 630–56.
- Gehlen, Boris. 2018. "Zielkonflikte bei Aktienerstmissionen?" *Jahrbuch für Wirtschaftsgeschichte* 59 (1): 39–76.
- Grabas, Margit. 1992. *Konjunktur und Wachstum in Deutschland von 1895 bis 1914*. Berlin: Duncker & Humblot.
- Hanselaar, Rogier M., R. René Stulz, and A. van Dijk Mathijs. 2019. "Do Firms Issue More Equity when Markets Become More Liquid?" *Journal of Financial Economics* 133 (1): 64–82.
- Karolyi, G. Andrew, Kuan-Hui Lee, and Mathijs A. van Dijk. 2012. "Understanding Commonality in Liquidity Around the World." *Journal of Financial Economics* 105 (1): 82–112.
- Lehmann, Sybille H. 2014. "Taking Firms to the Stock Market: IPOs and the Importance of Large Banks in Imperial Germany, 1896–1913." *The Economic History Review* 67 (1): 92–122.
- Levine, Ross, and Sara Zervos. 1998. "Stock Markets, Banks, and Economic Growth." *The American Economic Review* 88 (3): 537–58.
- Moral, Felix. 1914. *Aktienkapital und Aktien-Emissionskurs bei industriellen Unternehmungen*. München: Duncker & Humblot.
- Naes, Randi, Johannes A. Skjeltorp, and Bernt Arne Odegaard. 2011. "Stock Market Liquidity and the Business Cycle." *The Journal of Finance* 66 (1): 139–76.
- Newey, Whitney K., and Kenneth D. West. 1987. "A Simple, Positive Semidefinite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." *Econometrica* 55 (3): 703–9.
- Obst, Georg. 1921. *Das Bankgeschäft. II. Band. Bankpolitik*. Stuttgart: Carl Ernst Poeschel Verlag.
- Prion, Willi. 1910. *Die Preisbildung an der Wertpapierbörse, insbesondere auf dem Industrieaktienmarkt der Berliner Börse*. Leipzig: Duncker & Humblot.
- Rajan, Rajan G., and Luigi Zingales. 2003. "The Great Reversals: the Politics of Financial Development in the Twentieth Century." *Journal of Financial Economics* 69 (1): 5–50.
- Rousseau, Peter L., and Paul Wachtel. 2000. "Equity Markets and Growth: Cross-Country Evidence on Timing and Outcomes, 1980–1995." *Journal of Banking & Finance* 24 (12): 1933–57.
- Statistisches Reichsamt. 1899–1914. *Vierteljahrshefte zur Statistik des Deutschen Reichs*, Vols. 8–23. Berlin: Kaiserliches Statistisches Amt.
- Wolff, Siegfried. 1915. *Das Gründungsgeschäft im deutschen Bankgewerbe*. Stuttgart: Cotta.