The Great Depression as a Saving Glut

VICTOR DEGORCE AND ERIC MONNET

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Facing the Great Depression, Keynes blamed the detrimental consequences of precautionary savings on growth (paradox of thrift). Yet, the magnitude, forms and effects of savings accumulation remain unexplored in studies on the international economic crash of the 1930s. Based on new data for 22 countries, we document that the Great Depression was associated with a large international increase in savings institutions' deposits. Banking crises spurred precautionary savings. Panel estimations show a negative conditional correlation between real GDP and deposits in savings institutions when a banking crisis hit. Results are similar when we include life insurances (for a more limited number of countries where data are available). A back-of-the-envelope calculation suggests that the negative effect of precautionary savings on growth was at least as large as the direct effect of the decline in banking activity. Banking crises thus had an impact on economic growth also indirectly through an increase in precautionary savings. The evolution of the saving rate began to reverse as countries left the gold standard and started to implement various policies providing macroeconomic insurance.

Keywords: Great Depression, banking crises, precautionary savings, paradox of thrift, savings banks.

JEL codes: B22, E21, E51, G01, G21, N1, N2.

* Degorce: European Business School (EBS) & EHESS, 15 Rue Saint-Lambert, 75015 Paris (e-mail: victor.degorce@ehess.fr). Monnet: Paris School of Economics (PSE), EHESS, & CEPR, 48 Boulevard Jourdan, Paris, 75014 (e-mail: eric.monnet@psemail.eu). We thank Marc Adam, Thomas Belaich, Barry Eichengreen, François Geerolf, Harold James, Matt Jaremski, Alain Naef Angelo Riva, Stefano Ungaro for comments and helpful discussions, as well as seminar participants at EBS and INET. The following people provided invaluable help for finding and interpreting data from different countries: Flora Macher, Tamas Vonyo, Kiril Kossev, Peter Kugler, Joost Jonker, Ruben Peeters, Amaury de Vicq, Jan Tore Klovland, Karsten Gerdrup, Kim Abildgren, Stéphanie Collet, Ryland Thomas, Mark Billings, Masato Shizume, Pedro Lains and Pierre-Cyrille Hautcoeur This study was financed by the ANR (Agence Nationale pour la Recherche) under project name SYSRI 30 (ANR-15-CE26-0008).

There are today many well-wishers of their country who believe that the most useful thing which they and their neighbours can do to mend the situation is to save more than usual. […] It is utterly harmful and misguided – the very opposite of the truth.
J.M. Keynes (1931, II.6 p.151).

The 2008-2009 Global Crisis and the recent pandemic have been followed by a rise in savings. More generally, the fall in real interest rates since the beginning of the 21st century raises fears of secular stagnation due to excess savings. These trends have rekindled the interest of economists and policymakers in the *paradox of thrift*, formulated by Keynes in the 1930s (Keynes 1931, 1936; see Chamley 2012, 2014, Eggertsson & Krugman 2012, Guerrieri & Lorenzoni 2017, Benigno & Fornaro 2018, Fornaro & Romei 2019, Geerolf 2019, Challe 2020 for recent theoretical refinements). The paradox of thrift asserts that an increase in savings does not naturally lead to an increase in investment. On the contrary, it is detrimental to growth because it crowds out consumption and thus depresses aggregate demand.

Although Keynes' *paradox of thrift* was formulated in the context of the Great Depression of the 1930s, both the Great Depression studies and the recent theoretical literature on precautionary saving have surprisingly left aside the fate of savings and its consequences during this historical period. It is key for the literature on the *paradox of thrift* to come back to the Great Depression for at least three reasons. First, as Ben Bernanke (1995) once wrote, "to understand the Great Depression is the Holy Grail of macroeconomics". It certainly remains the matrix of most current macroeconomic theories on money (Friedman & Schwartz 1963), credit (Bernanke 1983), aggregate demand (Keynes 1936, Temin 1976, Romer 1992), the international monetary system (Eichengreen 1992) or shift in expectations (Eggertsson 2008). Thus, the current lack of empirical evidence on a paradox of the thrift during the 1930s remains a smoking gun for economists who

doubt the existence of such a mechanism. Second, the Great Depression actually seems an ideal field to test the paradox of thrift because agents had little or no access to insurance during this period. A key feature of theoretical models of the paradox of thrift is the accumulation of precautionary savings as an insurance against future shocks on unemployment or credit (see Challe et al. 2017 for a review). If financial markets or governments provide a complete insurance, there is no Keynesian effect. When the Great Depression hit, pension systems and unemployment insurance were almost non-existent. Stimulus programs in the 1930s helped to restore confidence by introducing such insurance schemes, particularly on unemployment or bank deposits (Eggertsson 2008). Third, the Great Depression was also a series of banking crises unprecedented – and unseen since then – around the world. Unlike in 2008-2009, governments and central banks did not undertake massive interventions to avoid them. This context therefore provides the ideal framework to test whether credit crises specifically lead to an increase in precautionary savings that depresses economic growth and real interest rates as in the model of Guerrieri & Lorenzoni (2017). If Keynes' hypothesis is not empirically validated for the Great Depression – in a world with little macroeconomic insurance and full of banking crises – it is difficult to imagine it being so today.

Based on a new dataset covering 22 countries, this article documents that savings increased sharply when banking crises hit during the Great Depression of the 1930s. The increase in savings everywhere took the form of deposits in savings institutions. These institutions (postal savings, mutual savings, savings trustees, etc.) had been created in the 19th century to encourage the development of savings. They were clearly distinguished from commercial banks, both in national statistics and in the eyes of depositors and governments. They were the most welcoming haven for precautionary savings. On average, in our sample of 22 countries, bank deposits *decreased* by 14.4% between 1928 and 1933. Meanwhile, deposits in savings institutions *increased* by 116.5%. In terms of GDP, the figures are equally

striking: deposits in savings institutions increased from 16% to 24% of GDP on average, whereas deposits in banks fell in the same way as GDP (their share in GDP remained constant).

The increase in savings institutions 'deposits was not specific to few countries but a worldwide feature of the Depression. We also document that the increase in precautionary savings occurs through investment in life insurance. We nevertheless present the analysis of life insurance as a robustness check, because the data are less complete, less reliable, and this phenomenon was limited to a few countries (the role of life insurance being particularly high in the United States). These series are compared to currency in circulation. Cash hoarding ("under the mattress") has received most of the attention in previous work on the Great Depression since Fisher (1932) but turns out to be of minor importance according to our data.

After documenting a large increase in savings, in accord with Keynes' paradox of thrift, we investigate further the economic mechanisms at work. Our hypothesis – based on historical narratives and the model of Guerrieri & Lorenzoni (2017) – is that banking crises pushed households and firms to accumulate precautionary savings. They created uncertainty about future economic and financial outcomes, which led agents to save and forego present consumption. In addition to the fall in credit, the rise in precautionary savings created a negative aggregate demand shock that depressed economic growth. Consistent with this hypothesis, we find a negative conditional correlation between real GDP and savings in a dynamic panel estimation with country-fixed and year-fixed effects when a banking crisis hit. On the contrary, endogeneity between savings and income – through the accounting identity – would normally lead to observe a positive correlation between the two: falling output pushes income and savings down (even if the fall in output was initially caused by an exogenous rise in savings).

The negative correlation between savings and GDP is identified conditionally on the evolution of bank deposits and a banking crisis dummy. This means that there

was a negative effect of precautionary savings that worked separately from the direct effect of banking crises on growth (i.e. through the decline in bank deposits and credit documented in Friedman and Schwartz 1963, Bernanke 1983, Bernanke and James 1991, etc.). A back-of-the-envelope calculation suggests that the negative effect of precautionary savings on growth was at least as large as the direct effect of the decline in banking activity during the years when the banking crises were most intense (1930-1932). Each of these two factors accounted for about 15 % of the overall decline in real GDP. When we include life insurances in the estimations (with data available for 15 countries only), the magnitude of the results is close. Furthermore, as predicted by theoretical models of the paradox of thrift (Chamley 2012, Guerrieri & Lorenzoni 2017, Benigno & Fornaro 2018), we also find a negative correlation between precautionary savings and real long-term interest rates.

We also provide robustness checks with alternative definitions of banking crises and we show that the significance of our results is reinforced when using the Arellano-Bond generalized method of moments estimator for dynamic panels, rather than ordinary least squares. Most important, we show that our observed empirical effect is indeed specific to banking crises: there is no significant effect when we interact our measure of precautionary savings with year-fixed effects in the Great Depression period (1929, 1930, 1931). This test also rules out the possibility that our results might be driven by the stock market crash of 1929 that spread worldwide, contrary to banking crises that were more sequential and heterogeneous across countries. Readers should keep in mind, however, that endogeneity problems would lead us to underestimate the negative effect of precautionary savings on growth. It is thus possible that the paradox of thrift was at play outside of banking crises although we cannot identify and observe it. Last, we show that banking crises were not predicted by a rise in precautionary savings in the previous year (by contrast, lagged banking deposits are positively correlated

with the probability of crisis). This is important to assess the direction of causality and thus to interpret the negative correlation between savings and GDP as a consequence of banking crises as in the model of Guerrieri & Lorenzoni (2017).

Our investigation can be seen as a follow-up to Christina Romer (1990)'s seminal argument on the consequences of the 1929 US stock market crash. In a Keynesian perspective, she argued that uncertainty caused by the financial crash led people to forego the purchase of durable goods, at the expense of non-durables.[1] Our contribution nevertheless differs from hers in two important ways. First, we directly assess the "paradox of thrift" by looking at savings rather than at consumption. Estimations of the increase in savings were surprisingly missing from the extensive international literature on the Great Depression.[2] We have collected new data to construct series of deposits in savings institutions for 22 countries from 1920 to 1936, based on various national statistical sources (see *Primary sources* in the bibliography and Appendix A). Second, we emphasize banking crises, rather than stock market crashes, as the main source of uncertainty triggering the rise in precautionary savings. Although the two explanations are in no way contradictory (even in the US case), ours is more consistent with the international history of the Great Depression.[3] As Richard Grossman and Christopher Meissner write in a recent comparative survey : "although a number of stock-market crashes took place during the Great Depression, the scholarly consensus is that, with the possible

[1] Other important contributions that highlight the role of falling aggregate demand in the Great Depression are Temin (1976) and Eichengreen (1992). None of them documents an increase in precautionary savings. In Eichengreen (1992)'s international perspective, the detrimental effect of savings is viewed through the balance of payments: countries in a fixed-exchange rate regime (gold standard) with a current account in surplus sterilized capital inflows to avoid monetary expansion and international adjustment, thus leading to a deflationary spiral. In this perspective, current account surpluses (excess savings) led to a surge in foreign reserves held by the central bank. For studies on the debt-deflation channel, see references below.

[2] Baubeau et al. (2020) on France, Fiedman and Schwartz (1963) and Fleitas et al. (2020) on the USA, had already documented the rise in savings institutions deposits, but they did not draw conclusions in terms of the link between precautionary savings and aggregate demand. Bernanke and James (1991) also noted that savings deposits increased, without providing quantitative estimations and analysis.

[3] Mathy (2016) shows that the several waves of US banking panics from 1930 to 1933 were also associated with stock market volatility.

exception of the October 1929 crash on Wall Street (Romer, 1990), crises in securities markets were not important in bringing it about (Kindleberger, 1973, p. 108; Eichengreen, 1992), but were most often a consequence of the collapse of the banking and non-financial sectors of the economy" (Grossman and Meissner 2010, p. 320).

Our findings contribute to several strands of literature. First, the increase in precautionary savings during the Great Depression of the 1930s is similar to what has been observed after the 2008-2009 financial and banking crises (Mody et al. 2012, Carroll et al. 2019), during the Japanese deflation (Benhima & Massenot 2013), and again in the current crisis caused by the Covid-19 epidemic. Motivated by the recent context, the theoretical macro literature has turned back to the paradox of thrift (see references above). Our paper offers insights to this recent literature, not only by documenting a striking historical precedent, but also by shedding light on the link between banking crises and precautionary savings. Moreover, we also show that a policy change worked to tame the paradox of thrift during the Great Depression: in the 1930s, precautionary savings stabilized (in % of GDP) and decreased as soon as a country left the gold standard. Leaving the Gold Standard proved to be the most efficient way for governments to signal a change of policies, and to shift the expectations of firms and consumers (Temin and Wigmore 1984, Paolera and Taylor 1998, Eichengreen 2002 p27-28, Eggertsson 2008). Through a turn to flexible exchange rates and the implementation of various insurance schemes (unemployment insurance, deposit insurance and countercyclical fiscal policy), governments stopped the increase in precautionary savings.

Second, previous studies on the causes of the fall in aggregate demand during the Great Depression mostly considered the Fisher debt-deflation channel. The rising cost and quantity of debt pushed consumers to decrease their consumption (Mishkin 1978, Olney 1999, Hausman et al. 2019). We do not dispute the importance of such mechanism, but we highlight that rising indebtedness occurred at the same time as

a rise in precautionary savings. Fisher (1932) and Keynes (1931) themselves did not view these two channels are contradictory but as complements, as do recent empirical (Mian, Straub and Sufi 2020) and theoretical (Guerrieri and Lorenzoni 2017) contributions.

Third, our paper shows an additional effect of banking crises on growth which was absent from the existing literature, especially from the compelling work on banking crises and the Great Depression in international perspective (Bernanke and James 1991). Two effects of banking crises may have been confounded in previous studies. Using a banking crisis dummy or bank deposits to measure bank distress on the right-hand side of an equation might confound the direct effects (monetary or non-monetary; see Bernanke 1983) of banking crises on growth with the indirect effect that works through the increase in precautionary savings due to uncertainty. In our econometric specification, we use both measures (bank deposits and savings institutions deposits) and show that both mattered.[4] People saved more than the amount of cash they withdrew from the banks. This conclusion is of interest, more generally, for the literature that measures the macroeconomic effect of banking crises on growth (Bordo et al. 2001, Jorda et al. 2013, Romer and Romer 2017). Banking crises also affect economic growth through a rise in precautionary savings. It was known in theory (Guerrieri & Lorenzoni 2017) but remained to be demonstrated by empirical work.

The reminder of the paper is structured as follows. In Section I, we present our empirical methodology and new data on savings institutions for 22 countries in the interwar (a detailed presentation of sources and figures for each country is in the

[4] In other words, the increase in savings deposits was not simply a counterpart to the decrease in liquid bank deposits. Otherwise, the growth rates of bank deposits and savings institutions deposits would measure the same thing. Monnet, Ungaro and Riva (2020) reach the same conclusion in their investigation of the causal effect of bank runs in France during the Great Depression. They estimate the effect of the growth rate of banking activity on GDP growth through instrumental variables. Doing so, they control for deposits in savings institutions and find that both channels (bank actitity and precautionary savings) worked independently.

appendix section). In Section II, we document the increase in precautionary savings. In Section III, we run a series of panel regressions to provide further support to the paradox of thrift and investigate the role of banking crises. The relationship between deposits in savings institutions and GDP growth turned negative when countries experienced a banking crisis. These results are robust to a series of alternative econometric specifications, including generalized methods of moments (GMM), to changes in the definition of banking crises and the use of data on life insurances when available. A negative correlation is also observed when the dependent variable is the real interest rate. Lagged precautionary savings did not predict banking crises. The discussion ends by showing that the evolution of the savings rate began to reverse as countries exited the gold standard.

I. Data and definition of savings

What kind of savings data should we look for?

Two preliminary remarks are important regarding the statistics we need to collect in order to test for Keynes'paradox of thrift.

First, the relevant series to observe, in accord with theory, is a flow of gross savings. The series used in current studies on precautionary savings is thus the personal saving rate, that is the percentage of their disposable income that people save (Carroll et al. 2019). The reason for this is that we are interested in how the marginal propensity to consume is affected by precautionary savings, that is how present consumption is foregone to the future (Challe et al. 2017 etc.). It stands in contrast with studies that measure savings in order to construct the stock of wealth in the economy (Piketty & Zucman 2014) or studies that measure savings through the accounting identity of the current account: CA= S – I (Jones & Obstfeld 1997). These other approaches take savings as a gross or net stock, usually cannot distinguish between savings of the governments, households and firms, and thus

are not suited to measure an impact of new savings on the marginal propensity to consume.

Second, we are interested in the flows of actual savings (income that is not spent) and not in the fluctuations of the market value of existing savings. A sudden decrease in the value of the stock portfolio or of the housing good of a household, for example, cannot be seen as a decrease in savings that increases the marginal propensity to consume of this household.

These remarks lead us to the following conclusions and methodological choices. The limitations of data on the interwar period prevent us from computing a personal saving rate, or even a reasonable proxy for it. Good data on consumption are available for the United States only and do not even cover all goods and households. Instead, we take the opposite side of the coin and look for institutions where precautionary savings – if it existed – may have been deposited. If this kind of savings increased more than total income, we will interpret these statistics as a rise in precautionary savings, assuming that this increase was made at the expense of consumption.

While previous studies have often assumed that cash hoarding was the primary vehicle of precautionary savings during the Great Depression, we will show that the best candidates were instead savings institutions and life insurances. Other forms of savings, such as stocks and bonds, were usually not directly held by households and, most important, their value was mostly driven by their market price. Life insurances might also be partly subject to this problem as – depending on the contract – the value of life insurance policies might decrease with the value of the securities held by the insurance manager. This is why we will introduce them as a robustness check only in Section III (besides the fact that it is often difficult to obtain comparable and reliable data on them for a large number of countries). We will focus first on data on savings institutions, a key feature of interwar financial systems internationally.

An important assumption underlying our method is that the increase in savings that we observe in these institutions is mainly due to precautionary savings, and not to a reallocation of savings within household portfolios, from bonds, shares or bank deposits to savings institution deposits, cash or life insurance. Given the limitation of data from the inter-war period, this hypothesis cannot be fully proven, although the institutional and historical context gives good reason to believe so. Yet, the purpose of our econometric investigation will be to test it. If there was a reallocation of savings instead of a rise in precautionary savings, we should not observe a paradox of thrift, that is a negative effect of savings on growth. Hence, our data construction strategy simply aims to identify at least one type of savings that is a good candidate to test for a paradox of thrift in an econometric framework. We cannot and will not compute a comprehensive personal saving rate.

Savings institutions

Savings institutions were an important feature of financial systems since the 19th century. Most often set up as state-sponsored institutions, they had been designed to promote savings and thrift by making safe and interest-bearing deposits accessible to low-income households. Contrary to banks or to building societies, which were also often created by the state or in the forms of cooperatives, savings institutions were not primarily aimed at increasing the access to credit but at encouraging and protecting savings.[5] They often collected money saved for retirement or unemployment insurance, at a time when pension funds and social welfare systems were almost non-existent. Their institutional form and their economic importance varied greatly across countries. Most countries in fact had several forms of these institutions (postal savings, mutual savings, trustees, state-

[5] Deposits in those institutions were usually liquid, although not as liquid as demand deposits in banks. But rules varied greatly from one country to another. Common practice is to not include these deposits in money aggregates although it is disputable from some countries.

run monopolistic deposit institution, etc.). To account for the large diversity of institutions across countries, including those that were only allowed to have government securities or cash on their asset side, we use the more general term "savings institutions" rather than "saving banks". This characterizes all these deposit-taking institutions whose business model differed from commercial and cooperative banks. Despite this institutional diversity, historians have emphasized that they formed a consistent entity that differed significantly from banks (Vogler 1991, Mura 1996). This difference also clearly appeared in all national statistical publications that we consulted for the data collection.

Like commercial banks, savings institutions collected deposits. Yet, they differed from commercial banks because they invested in very safe assets, usually securities with a long maturity or cash. In some countries, they were required by law to invest all their funds in government bonds (Bruck 1995, Proettel 2016, Baubeau et al. 2020). In countries where they enjoyed some autonomy from the state, savings banks generally followed conservative lending policies, which enhanced their reputation (Andersson & Rodriguez 2013, Martin-Acena 2013). Their long-term loans were always significantly safer than those of banks and limited to few sectors (mainly housing and agriculture). Where mutual savings banks were organized as cooperatives (the prominent example being the US mutual savings banks; Jaremski & Plastaras 2016), their lending activities were also notoriously less risky than those of commercial banks and they did not compete with the latter. Cooperative banks whose first aim was to grant credit to local businesses (such as *Raiffeisen'* s credit cooperatives in several European countries) are not considered as savings banks.

Despite being often neglected in quantitative historical analyses of interwar banking systems, savings institutions collected a large share of total savings. In our sample of 22 countries, the average share of total deposits held in savings institutions in 1928 (that is before the banking crises of the Great Depression) was

41 %. The same year, it reached a maximum in Denmark (78%) and Norway (69%). Even in countries with more developed banking systems, savings institutions deposits were significant.[6] In the 1930s, the average share increased sharply, to reach 53.5% in 1935, with 10 countries out of 22 in our sample having more than 50% of total deposits held in savings institutions in this year.

Historical sources and sample

The vast literature on banking crises during the Great Depression has overlooked the importance of savings institutions. Because the latter did not fail, contrary to banks, economic historians neglects their potential role in the transmission and persistence of the financial crash and economic depression. This lack of attention is especially striking given that their statistics were widely published during this period. The League of Nations, for example, constantly published some figures on savings institutions, in addition to those of banks, in their Statistical Yearbooks.[7] Yet, our initial investigation led us to the conclusion that the statistics of the League of Nations were sometimes incomplete as they focused on the larger savings institutions only (probably because they did not have access in real time to the annual reports of the smaller ones, that were published in national statistical volumes retrospectively).[8] Thus, we have collected new data to construct series of deposits in savings institutions for 22 countries from 1920 to 1936. Our sources are mostly annual volumes published by national statistical institutes (see *Primary*

[6] Comparable figures are 35% for Germany, 28% for the US, 25% for the UK and 24% for France.

[7] Mitchell (2013) also publishes data on deposits in savings banks, but they are remarkably incomplete on the interwar period (without justification to exclude or include some types of institutions, and even sometimes adding deposits in commercial banks to these deposits). As a starting point, we found that statistics published by the League of Nations were much more comprehensive and reliable.

[8] There is a similar bias for banks in the statistics of the League of Nations. Hence, for banks as well, we often use statistics reconstructed retrospectively by economic historians. See below.

sources in the bibliography and Appendix A).[9] Most of these volumes were published retrospectively, with an attempt to be as comprehensive as possible. Although this dataset is new and richer than previous international statistics published on the matter, we have followed conventional definitions of savings institutions. Volumes published by national statistical institutes or central banks always clearly distinguished these institutions from banks. Appendix A lists all the institutions whose deposits are included in the dataset.

Our sample includes mostly countries of North America and Europe, the two richest part of the World and the hardest hit by banking crises and the Great Depression. Overall, the 22 countries included in our sample account for 75% of world real GDP in 1930 (Inklaar *et al* 2018). Eastern European countries, in particular, are well-known for having suffered from intense banking crises during the Great Depression (Bernanke & James 1991, Eichengreen 1992). Almost all Eastern European countries are included in our sample.[10] We also include Scandinavian countries. Although these countries experienced banking crises in the early 1930s, they also notoriously suffered from banking crises in the early 1920s (Bernanke & James 1991, Eichengreen 1992). Last, we also include Japan, a peculiar case as the country was hit by a very severe banking crisis in 1927-1928, few years before the international Great Depression.

We use our new data on savings institutions together with other monetary and macroeconomic variables that are more common in the literature (see Appendix A and B for a presentation of sources). As for data on bank deposits, we mainly rely on national statistical yearbooks or the League of Nations Statistical Yearbooks. We have only updated these series in few cases when historians recently published

[9] Even when we use the statistics from the League of Nations, we have consistently checked original national sources to make sure that the work of the League was comprehensive.

[10] Countries included in our sample are the following: Austria, Belgium, Bulgaria, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, United Kingdom, United States and Yugoslavia. See Appendix A & C.

more reliable data than the ones previously used, as for France (Baubeau et al. 2020) and Italy (Natoli et al. 2016.). Likewise, we have slightly updated the existing series of banking crises provided by Bernanke and James (1991), taking stock of the new analysis of these events in France (Baubeau et al. 2020) and Spain (Jorge-Sotelo 2019). Real GDP data for our 22 countries come from Inklaar *et al* (2018). Nominal GDP data are from Bordo et al. (2001) and only available for 17 countries. Data on cash were already used in the literature and are from Mitchell (2013) who draws on the League of Nations Statistical Yearbooks and national statistical yearbooks (we checked Mitchell's data by going back to the original publications). Appendix C shows the series of savings institutions deposits, commercial banks deposits and currency in circulation, as well as the dates of banking crisis, for each of our 22 countries in our database.

II. Stylized facts

Figure 1 presents the evolution of the ratio of deposits in savings institutions to deposit in commercial banks. The ratio is set equal to 100 when the volumes of both types of deposits are equal. It is higher than 100 when deposits in savings institutions exceed deposits in banks. We average this ratio across our 22 countries. Average values obviously hide important differences across countries, as shown in Appendix C. Yet, whatever the starting point, there is a striking increase in the ratio in all countries around 1929-1930-1931 when the first banking crises of the Great Depression strike. On Figure 1, the average ratio increases from 71.3 in 1928 to 115.8 in 1932. Figure 1 also suggests that the increase in the ratio started before the Great Depression, as soon as 1926. This is mostly due to few countries, especially Japan, that experienced a banking crisis in 1927-1928. Excluding Japan and Scandinavian countries, which experienced strong instability in their banking systems in the mid-1920s, we find that the ratio was stable around

35 from 1925 to 1928 and then increased to 45 in 1929 and reached 84 in 1932 and 95 in 1935.

FIGURE 1: RATIO OF DEPOSITS IN SAVINGS INSTITUTIONS TO DEPOSITS IN COMMERCIAL BANKS

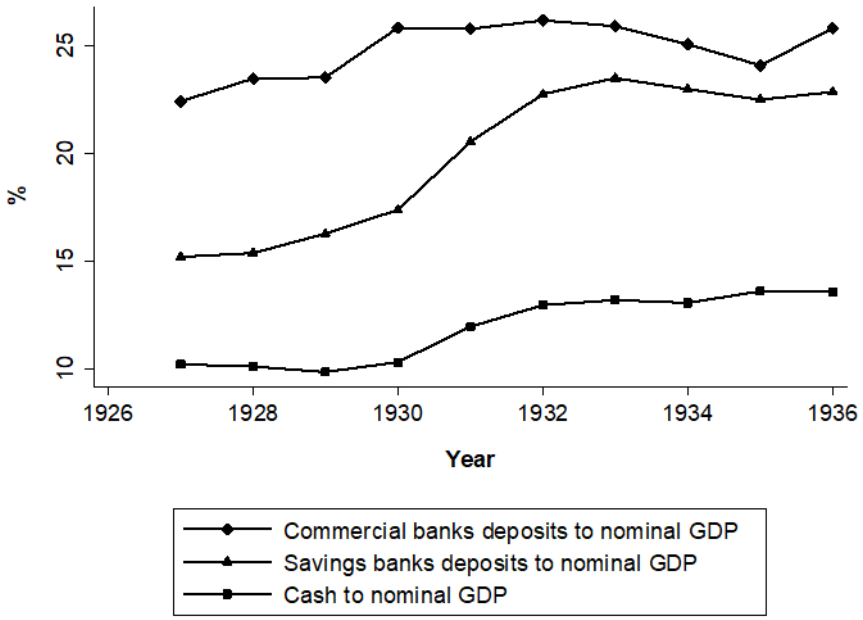
Note: unweighted average of the data for the 22 countries in our sample.

Sources: see Appendix.

The increase in the ratio is not only due to a fall in bank deposits, but mostly to a nominal increase in deposits in savings institutions (see Appendix C). On average, bank deposits decreased by 14.4% between 1928 and 1933 while savings bank deposits increased by 116.5%. Thus Figure 1 and Appendix C show that, if one wants to look for precautionary savings during the Great Depression, it is necessary to consider savings institutions. While bank failed, suffered from runs and decreased substantially their activity in response to falling output, the deposits in saving institutions strikingly increased in nominal terms, despite the world being hit by deflation.

Figure 2 shows how these different forms of deposits compared to nominal GDP. Since previous investigations had mostly considered cash hoarding as a vehicle for precautionary savings, we also plot the ratio of cash to GDP. The Figure displays two striking findings that shed a new light on the history of the Great Depression. First, deposits in savings institutions increased massively as a % of GDP. Second, the ratio of cash to GDP increased more modestly than the ratio of savings deposits to GDP. The increase in cash-to-GDP is in fact mostly pulled by the drop in GDP. In our sample of 22 countries, the nominal quantity of cash increased in 6 countries only while deposits in savings institutions increased everywhere. It is consistent with the well-known fact that, overall, central banks did not respond to the Great Depression by increasing base money (at least before they exited the gold standard). So, if there were some cash hoarding, it was limited by the quantity of cash in circulation, itself constrained by the rules of the gold standard. Moreover, deposits in savings institutions still earned an interest rate, contrary to cash. Scholars had previously considered that the increase in cash to GDP implied a drop in the velocity of money (Fisher 1932, Friedman & Schwartz 1963, Anderson et al. 2017). We do not dispute this. Our point is simply that there was not enough cash in circulation to welcome a large increase in precautionary savings. So, in aggregate, cash hoarding was not the primary vehicle for precautionary savings during the Great Depression.

FIGURE 2: AVERAGE RATIO OF BANK DEPOSITS, SAVINGS INSTITUTIONS DEPOSITS AND CASH IN CIRCULATION TO NOMINAL GDP, 1926-1936.



Note: unweighted average of the data for the 17 countries for which we have nominal GDP data.
Sources: see Appendix.

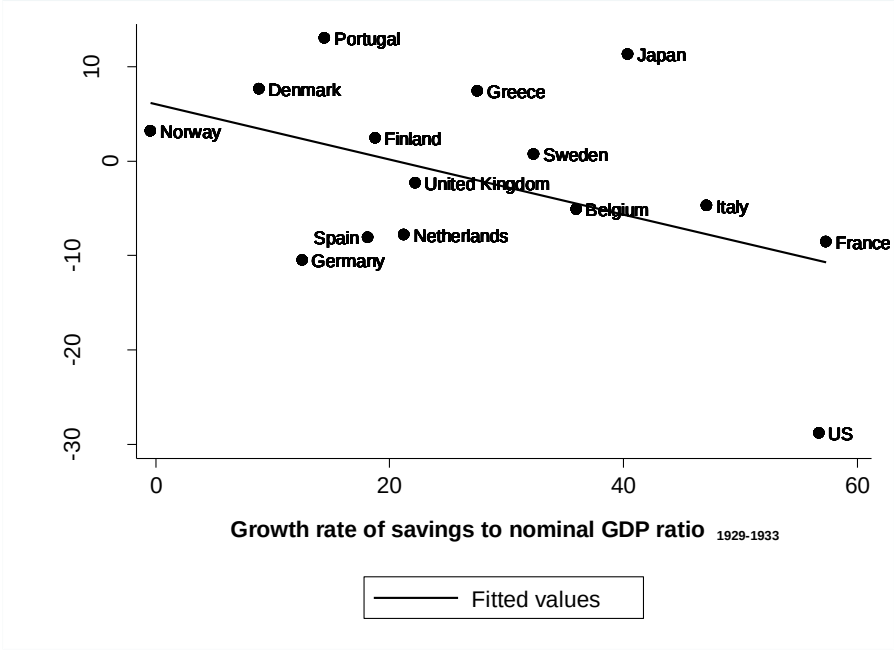
Last, consistent with Keynes's paradox of thrift, Figure 3 shows that our proxy for the saving rate (ratio of savings institutions deposits to GDP) increased more in countries where real GDP experienced lower growth.[11] The paradox of thrift states that an increase in savings may not increase investment and growth. On the contrary, an increase in savings pushes aggregate demand down when the economy is below potential.[12] Income – and eventually the quantity of savings –

[11] We focus on the years 1929-1933, when the Depression was the most severe internationally. But the conclusion is similar if we look at a longer sample.

[12] The availability of macroeconomic statistics for the interwar is notoriously very limited. GDP data have been mostly reconstructed retrospectively and are annual. They do not allow for a reliable distinction between GDP components such as

falls because the saving rate has increased. The problem is not that people save, but that they save more than usual when the economy is slowing down (Keynes 1931, 1936).[13] The cross-country comparison of ratios on Figure 3 could be simply driven by the diverse magnitudes of the fall in GDP however. This is why we now turn to simple econometric regressions, where we can look at the conditional evolutions of the levels of real GDP and savings, taking country characteristics as given.

FIGURE 3: CROSS-COUNTRY CORRELATION BETWEEN THE INCREASE IN SAVING RATE AND REAL GDP GROWTH DURING THE GREAT DEPRESSION (1929-1933)



R-squared=0.23 Coef=-0.29. Note: savings is measured as deposits in savings institutions. Sources: see Appendix.

consumption and investment. Monthly data on production and deposits would be jointly available for a very limited number of countries over this period. It prevents any attempt to test our hypothesis with higher frequency data.

[13] In Keynes'words: "There are today many well-wishers of their country who believe that the most useful thing which they and their neighbours can do to mend the situation is to save more than usual.[…] It is utterly harmful and misguided – the very opposite of the truth. For the object of saving is to release labour for employment on producing capital goods such as houses, factories, roads, machines and the like. But if there is a large unemployed surplus already available for such purposes, then the effect of saving is merely to add to this surplus and therefore to increase the number of the unemployed " (Keynes, "The Economy. Saving and spending." In Essays in persuasion, p.151.)

III. Panel data econometrics

Identification and potential channels

Our hypothesis is that a banking crisis increases precautionary savings because it increases uncertainty. As in Keynes (1931, Part II, chp.6, 1936 chp.7), Romer (1990), Mody et al. (2012), Mathy (2016) and Guerrieri and Lorenzoni (2017), a financial or credit crunch sends a signal that the economy will be depressed, so that unemployment and real cost of debt may increase. Agents form negative and uncertain expectations about the future, and they save more than usual to protect themselves against negative financial and income shocks. This behavior is described in Deaton (1991)'s canonical model of saving and liquidity constraints. If the savings accumulation creates a paradox of thrift, we should observe a negative correlation between GDP and precautionary savings when a banking crisis hits. The increase in savings is an aggregate demand shock. Thus, our identification is based on the hypothesis that a banking crisis creates a sudden increase in precautionary savings that is relatively exogenous to the level of GDP.

We now discuss four issues that might undermine our identification, and how we address each of them. First, we cannot rule out reverse causality. However, an endogenous bias will underestimate the effect we are interested in. As already explained by Keynes, the paradox of thrift eventually leads to an observed decrease in savings coincident with a decrease in output (Chamley 2012, 2014). Savings first temporarily increases at the expense of consumption, but then decreases – through the accounting identity – as the fall in consumption pulls aggregate demand and income down. So, overall, even if a paradox of thrift exists, the endogeneity bias would make savings and GDP go down together and positively – rather than negatively – correlated. If we manage to observe a negative coefficient, it means that we have identified a paradox of thrift despite potential endogeneity concerns

going against our identification. Outside of banking crises years, we do not take a stance on whether the paradox of thrift was at work; we simply acknowledge that its effect cannot be identified because of reverse causality.

Second, we should take into account that deposits in savings institutions may also increase as a consequence of a flight-to-safety by bank depositors, rather than being an accumulation of new savings (Bernanke and James 1991, Baubeau et al. 2020). Banks are failing or are perceived as unsafe, so that depositors withdraw cash and they deposit the exact same amount in savings institutions. In this case, the increase in savings deposits is not "saving more than usual" but simply the counterpart of the decrease in bank deposits. In order to overcome this potential problem, we control for bank deposits in our estimations. For the same reason, we also control for cash in circulation. Although we believe it is important to account for this potential confounding effect, we stress however that it is quite unlikely that the entirety of the increase in savings would be only the counterpart of the withdrawals of bank deposits. The decrease in bank deposits could be mainly driven by the absence of roll-over of credit (itself driven by decreasing activity). Bank deposits may also be frozen when a bank fails or suspends convertibility, rather than being withdrawn. Moreover, as shown by Baubeau et al. (2020) and Monnet et al. (2020) in the French case, the increase in savings deposits was also pulled by remittances from abroad and deposits of new income flows (especially by firms).

Third, precautionary savings might increase globally during the years of the Great Depression for reasons unrelated to banking crises. This would not challenge the conclusions about a paradox of thrift but it would go against our main interpretation on the identification of the cause of the surge in savings. In order to confirm that our results are indeed driven by the consequences of local banking crises rather than by general international uncertainty, we will present an alternative specification where we interact savings deposits with year dummies instead of a banking crisis dummy.

Fourth, banking crises might themselves be caused by an increase in precautionary savings. If true, the sign of the interaction coefficient might capture the fact that banking crises had a stronger effect on growth when they were the consequence of an increase in precautionary savings. It would be inconsistent with the interpretation of Guerrieri & Lorenzoni (2017). To rule out this hypothesis, we will provide results showing that banking crises are not predicted by precautionary savings.

Estimations

We rely on the standard dynamic panel specification of the literature that investigates the effect of banking crises on growth:[14]

$$\mathrm{gdp}_{i,t} = \alpha + d_t + c_i + \beta.\mathrm{gdp}_{i,t-1} + \gamma.\mathrm{prices}_{i,t}$$
$$+\theta.BankCrisis_{i,t} * savings_{i,t} + \infty.BankCrisis_{i,t} + \partial.savings_{i,t}$$
$$+\mu.\mathrm{bank}_{\mathrm{i,t}} + \pi.\mathrm{cash}_{\mathrm{i,t}} + \epsilon_{i,t} \quad (1)$$

We use real GDP on the left-hand side and nominal variables together with the price level in the right-hand side. As in standard growth regressions, lagged real GDP appears in the right-hand side to control for path dependency of GDP. All variables are in logarithms. The interaction term is $BankCrisis_{i,t} * savings_{i,t}$. We control for bank deposits and cash in circulation to be sure that the correlation between GDP and our measure of savings deposits does not confound other financial and monetary factors. We consider common shocks to all countries through year-fixed effects (d_t), as well as country-fixed effects (c_i). Hence, for a given country, we compare the conditional correlation between real GDP and precautionary savings

[14] Bernanke & James (1991) and Bernanke (1995) applied it to the Great Depression with international data.

in the years when the country experienced a banking crisis (θ) versus the years without banking crises (∂).

The Great Depression created a significant U shaped curve for real GDP, such that the logarithm of real GDP is actually stationary over the estimation period. We checked this claim with the test of Levin, Lin, and Chu's (2002) for the presence of unit root. Although we are using a dynamic panel with lagged GDP, we expect the Nickel Bias to be a minor issue since T is not so larger than N in our sample (22 countries vs. 16 years in the full sample, or 7 years when restricted to the Great Depression). Yet, we show the robustness of our results by using Generalized method of moments (GMM) with available lagged values as instruments (Arrelano et Bond 1991, Roodman 2009). When GMM is used, we check that we reject no autocorrelation of order 1 and cannot reject no autocorrelation of order 2 in the residuals of the first-difference equations.

For each specification, we present two sets of results. First, we use a sample (balanced panel) that focuses on the years of the Great Depression, that is 1929-1936. Second, we add degrees of freedom and estimate an unbalanced panel with data starting in 1920. The number of observations is twice as high as in our first sample. Several countries experienced major banking crises in the early 1920s. Using the full sample is thus a way to test whether the expected negative correlation between GDP and savings in years of banking crises was in fact a general feature of interwar financial systems. Indeed, there is no reason to believe that the paradox of thrift was specific to the Great Depression.

TABLE 1: PRECAUTIONARY SAVINGS, BANKING CRISES AND GROWTH

		1929-1936			1920-1936		1929-1936
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Banking crisis*Savings		-0.021**	-0.021**		-0.021**	-0.022*	
		(0.009)	(0.009)		(0.009)	(0.011)	
Savings	0.021*	0.025**	0.020	-0.008	-0.008	-0.008	
	(0.012)	(0.011)	(0.012)	(0.008)	(0.007)	(0.008)	
Banking crisis	0.008	0.182**	0.178**	-0.005	0.170**	0.179**	0.008
	(0.018)	(0.066)	(0.070)	(0.016)	(0.068)	(0.078)	(0.019)
Bank deposits	0.067*	0.066*	0.047	0.041**	0.040**	0.043***	0.060
	(0.035)	(0.032)	(0.031)	(0.019)	(0.018)	(0.014)	(0.036)
Cash	0.002	-0.014	-0.020	0.002	0.003	-0.030	0.016
	(0.029)	(0.032)	(0.036)	(0.022)	(0.022)	(0.029)	(0.030)
Lagged GDP	0.609***	0.622***	0.646***	0.700***	0.703***	0.661***	0.636***
	(0.052)	(0.045)	(0.046)	(0.072)	(0.068)	(0.078)	(0.056)
Prices	0.007	0.006	0.031	-0.093***	-0.096***	-0.079***	-0.026
	(0.046)	(0.043)	(0.043)	(0.030)	(0.029)	(0.023)	(0.050)
1929*Savings							0.009
							(0.008)
1930*Savings							-0.003
							(0.007)
1931*Savings							-0.002
							(0.007)
Observations	161	161	152	283	283	254	161
R-squared	0.676	0.696		0.885	0.891		0.676
AR2 test P-value			0.387			0.991	
Number of country	22	22	22	22	22	22	22
Country FE	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable is the logarithm of real GDP. Columns (1) and (4) are OLS estimations, without interaction terms. Other columns include interaction terms between a banking crisis dummy and deposits in savings institutions: (2) and (5) are estimated with OLS and (3) and (6) with GMM. In columns (1) to (3), the sample is the Great Depression (1929-1936) whereas columns (4) to (6) use similar specification on a larger interwar sample. Column (7) is estimated with OLS and include interaction terms between deposits in savings institutions and each of the three crisis years: 1929, 1930, 1931. All standard-errors are clustered at the country level and estimations include country-fixed and year-fixed effects.

In column (1) and (4), we first estimate our basic OLS equation without the interaction term, for the Great Depression and the full interwar sample respectively. The relationship between savings and GDP is either positive (1) or insignificant (4).

This is consistent with the reverse causality between income and savings discussed previously. Bank deposits are also unsurprisingly positively correlated with GDP. In columns (2) and (5), we introduce the interaction term. The relationship between savings and GDP turns negative when a country experiences a banking crisis. The coefficient on bank deposits remain significant and positive. When we move to estimations with GMM in columns (3) and (6), our coefficients of interest are unchanged.[15]

The coefficient associated with the interaction term implies that when deposits in savings institutions increase by 1%, GDP falls by 0.02% (Table 1, columns 2-3 & 5-6)). The average annual growth rate of those deposits in 1930, 1931 and 1932 (that is the years when most banking crises occurred) was 14%, with a standard deviation of 21%. Hence a positive standard deviation shock on savings deposits (21%) is associated with a fall of GDP by 0.4%. By contrast, the standard deviation of the growth of bank deposits (13%) is associated with a fall of GPD by 0.8% (according to the coefficient in Table 1, column 2). According to the same coefficients, the annual average increase in savings (14%) is associated with a drop in output equal to 0.28%, while the annual average decrease in bank deposits (5%) is associated with a drop in output equal to 0.33 %. In our sample, the average growth rate of real GDP during 1930-1932 was – 2%. Thus, a back-of-the-envelope calculation implies that the increase in savings explains 14% of the decrease in real GDP in 1930-1932, while the decrease in bank deposits explains 16%. It should be noted that this is an estimate of the lower bound of the effect of precautionary savings since reverse causality leads to an underestimation of this effect.

In column (7), we perform a simple check to confirm that our results are driven by the consequences of local banking crises (consistent with our hypothesis and identification) rather than by general international uncertainty. We interact savings

[15] This specification uses two lags for GMM instruments.

deposits with year dummies of 1929, 1930 and 1931, that is the three years when the world experienced large waves of financial and banking crises. None of these interaction terms is significant. We present the results on the estimation sample 1929-1936, but they are similar on the full sample.

Robustness checks: alternative definition of banking crises

Our definition and chronology of banking crises relied on the previous work of Bernanke and James (1991) who precisely documented each of the crises that appeared in their database. For France and Spain, we have updated their data, based on recent historiography (Baubeau et al. 2020; Jorge-Sotelo 2020). To show that our results are not dependent on one specific definition of banking crises, we show similar estimations using the widely used banking crisis coding of Reinhart and Rogoff, although we confidently believe that our coding of banking crisis is more in line with historical narratives. In their sample, the number of countries is smaller, 19 countries instead of 22. Table 2 displays the results with the Reinhart and Rogoff dummy. Our coefficient of interest falls slightly from -0.21 (in Table 1) to - 0.15 (Table 2), yet it remains significant and all other results are in line with the previous ones.

TABLE 2: ROBUSTNESS CHECKS WITH ALTERNATIVE DEFINITION OF BANKING CRISES

	1929-1936		1920-1936	
VARIABLES	(1)	(2)	(3)	(4)
Banking crisis*Savings	-0.015*	-0.015*	-0.016**	-0.015*
	(0.007)	(0.008)	(0.007)	(0.008)
Banking crisis	0.135**	0.131*	0.124**	0.113*
	(0.061)	(0.068)	(0.058)	(0.064)
Savings	0.017	0.014	-0.006	-0.007
	(0.013)	(0.012)	(0.006)	(0.007)
Bank deposits	0.048	0.021	0.045**	0.037**
	(0.039)	(0.034)	(0.019)	(0.016)
Cash	-0.006	-0.036	0.004	-0.044
	(0.049)	(0.044)	(0.024)	(0.031)
Lagged GDP	0.663***	0.679***	0.730***	0.682***
	(0.039)	(0.032)	(0.064)	(0.071)
Prices	0.034	0.073	-0.110***	-0.067**
	(0.051)	(0.043)	(0.031)	(0.028)
Observations	138	131	255	231
R-squared	0.726		0.906	
AR2 test P-value		0.389		0.998
Number of country	19	19	19	19
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

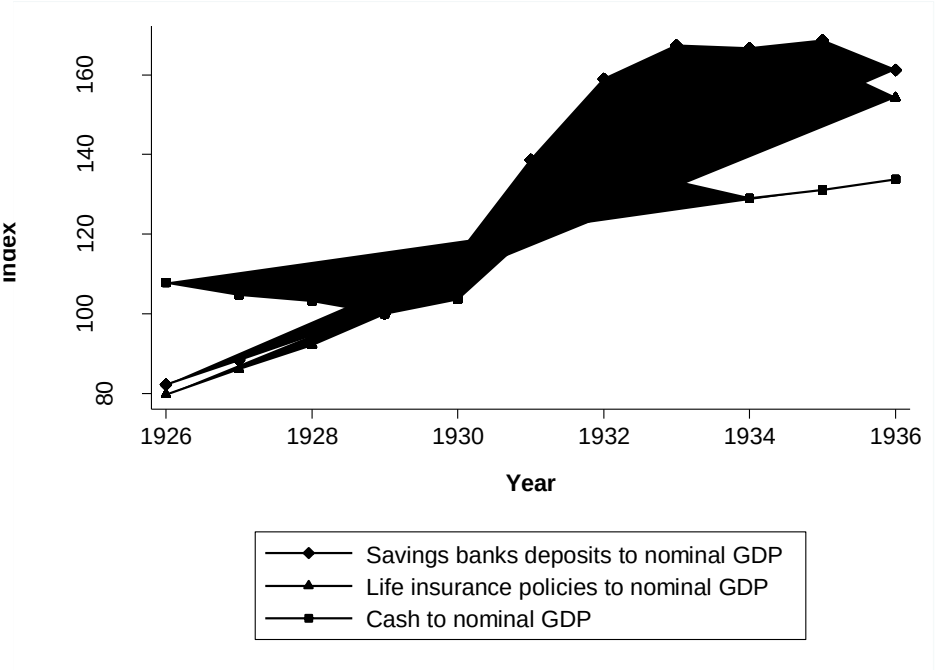
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable is the logarithm of real GDP. All columns include interaction terms between a banking crisis dummy and deposits in savings institutions: (1) and (3) are estimated with OLS and (2) and (4) with GMM. In columns (1) to (2), the sample is the Great Depression (1929-1936) whereas columns (2) and (4) use similar specification on a larger interwar sample. All standard-errors are clustered at the country level and estimations include country-fixed and year-fixed effects.

Robustness checks: life insurances

Life insurance policies were an important vehicle for savings in most developed countries (Radice 1939, Goldsmith 1955, Hautcoeur 2002). We collected data on life insurance policies for 15 countries in our sample (in the remaining 7 countries, life insurance companies were either non-existent or not sufficiently organized to report aggregated data). In these 15 countries, life insurance policies increased on average by 39% in nominal terms, between 1928 and 1933 (while savings deposits increased by 52%). Figure 3 shows that the ratio between life insurance policies and nominal GDP increases when banking crisis hit, but less than the ratio between savings deposits and nominal GDP.

FIGURE 3: INDEX OF THE RATIOS BETWEEN SAVINGS BANKS DEPOSITS, LIFE INSURANCE POLICIES AND CASH IN CIRCULATION TO NOMINAL GDP, 1926-1936.



Note: unweighted average of the data for the 15 countries for which we have nominal GDP and life insurance data.

Sources: see Appendix.

Based on these estimates, it seems that the fate of life insurance policies during the Great Depression was similar to that of savings deposits. However, caution should be applied when using life insurance policies data in international comparison. Indeed, life insurance policies often took the form of investment accounts. The value of an investment account depends on the value of stocks and bonds in which the capitals are invested. Since both the composition of life insurance companies' assets (eg: the share of assets invested in government bonds) and the fluctuation of these assets' price during the Depression differed widely from one country to another (Snowden 1995, Baker & Collins 2003, Hautcoeur 2002), it is quite difficult to draw conclusions on the behavior of life insurance savings based on our data (still, it is remarkable that life insurance policies *increased* on average by 39% between 1928 and 1933, while stock markets crashed in virtually every country of our sample). We nonetheless replicate our main regressions with an interaction term between our banking crisis dummy and the log of savings as explanatory variable (savings is now defined as the sum of savings deposits and life insurance policies). The number of observations is reduced by one third. The coefficient of interest falls slightly for the restricted sample (col 2 and 3) and increases slightly for the full interwar sample (col 4 and 5).

TABLE 3: ROBUSTNESS CHECK WITH LIFE INSURANCE POLICIES

	1929-1936			1920-1936		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Lagged GDP	0.417***	0.484***	0.565***	0.708***	0.721***	0.712***
	(0.053)	(0.077)	(0.066)	(0.060)	(0.048)	(0.051)
Prices	0.124	0.105	0.100	-0.055	-0.051	-0.053
	(0.079)	(0.082)	(0.077)	(0.034)	(0.036)	(0.039)
Banking crisis*Savings		-0.017	-0.020*		-0.028**	-0.029**
		(0.011)	(0.010)		(0.010)	(0.010)
Banking crisis	-0.006	0.155	0.185*	-0.018	0.243**	0.255***
	(0.016)	(0.107)	(0.093)	(0.019)	(0.087)	(0.086)
Savings	0.064	0.056	-0.015	-0.028**	-0.030***	-0.033**
	(0.075)	(0.073)	(0.055)	(0.011)	(0.010)	(0.010)
Bank deposits	0.156***	0.132***	0.121***	0.044***	0.036***	0.045***
	(0.048)	(0.043)	(0.037)	(0.014)	(0.011)	(0.013)
Cash	-0.083	-0.083	-0.070	-0.014	-0.011	-0.025
	(0.057)	(0.062)	(0.055)	(0.026)	(0.025)	(0.031)
Constant	4.903***	4.497***		3.496***	3.384***	
	(0.933)	(1.087)		(0.737)	(0.564)	
Observations	104	104	100	198	198	178
R-squared	0.688	0.700		0.902	0.913	
Number of country	15	15	15	15	15	15
Country FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Robust standard errors in parentheses						
*** p<0.01, ** p<0.05, * p<0.1						

Notes: The dependent variable is the logarithm of real GDP. Columns (1) and (4) are OLS estimations, without interaction terms. Other columns include interaction terms between a banking crisis dummy and the sum of savings deposits and life insurance policies: (2) and (5) are estimated with OLS and (3) and (6) with GMM. In columns (1) to (3), the sample is the Great Depression (1929-1936) whereas columns (4) to (6) use similar specification on a larger interwar sample. All standard-errors are clustered at the country level and estimations include country-fixed and year-fixed effects.

Robustness checks: endogeneity of banking crisis

Temin (1976) famously argued that banking crisis (and the resulting drop in GDP) were the consequences of an "autonomous" contraction in demand (or, similarly, of an "autonomous" increase in savings). In this argument, banking crisis are endogenous responses to the initial drop in consumption. The Temin hypothesis

does not question the existence of a paradox of thrift but could undermine our identification strategy since we argue that banking crisis triggered an increase in savings. We therefore control for this eventuality. If Temin's hypothesis were valid, banking crisis could be accurately predicted by the increase in savings. We therefore run a test with a banking crisis dummy as dependent variable, and savings deposits as independent variable. The results confirm our hypothesis (and invalidate Temin's): savings deposits do not predict banking crisis; rather, banking crisis are caused by a credit boom (proxied by the bank deposited variable), as emphasized by Schularick and Taylor (2012).

TABLE 3: ENDOGENEITY OF BANKING CRISIS

VARIABLES	1929-1936	1920-1936
Lagged real GDP	0.632	-0.285
	(0.468)	(0.268)
Lagged price	0.364	0.090
	(0.372)	(0.217)
Lagged savings	-0.013	-0.076
	(0.091)	(0.056)
Lagged bank deposits	0.184	0.211**
	(0.281)	(0.091)
Lagged cash	0.240	0.143
	(0.271)	(0.175)
Constant	-11.996***	0.543
	(3.950)	(3.245)
Observations	163	278
Number of country	22	22
R-squared	0.307	0.242
Country FE	YES	YES
Year FE	YES	YES

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

Notes: The dependent variable is a banking crisis dummy. The two columns are OLS estimations, without interaction terms. All standard-errors are clustered at the country level and estimations include country-fixed and year-fixed effects.

Interest rates

Theoretical models of the paradox of thrift predict that an increase in precautionary savings leads to a decrease in the safe long-term real interest rate (Chamley 2012, Guerrieri & Lorenzoni 2017, Benigno & Fornaro 2018). We test whether our data are consistent with this prediction. As for long-term rates, we use yields on long-term government bonds. The sample is then restricted to 20 countries (see appendix B for sources of data). To calculate real rates, we follow the Fisher equation and subtract the expected inflation rate from the nominal rate. We predict the expected inflation rate based on an autoregressive equation with one lag of inflation and one lag of GDP, estimated over the whole interwar sample (excluding hyperinflations). In order to consider the real long-term rate as a safe rate, we exclude observations in years when countries experienced a public debt crisis. Results are reported in Table 5. According to the OLS estimation (column 1), a 1% increase in precautionary savings in a banking crisis is associated with a decrease in the interest rate by 75 basis points (94 basis points with GMM estimation; column 2). Estimations lead to similar conclusions if we use the nominal rate (instead of the real rate), or when we do not exclude public debt crises, although the coefficient are smaller in both cases (results not reported here).

TABLE 5: PRECAUTIONARY SAVINGS, BANKING CRISES AND INTEREST RATES

	1929-1936		1920-1936	
VARIABLES	(1)	(2)	(3)	(4)
Banking crisis*Savings	-0.755*	-0.945**	-1.034***	-0.989**
	(0.391)	(0.427)	(0.305)	(0.414)
Banking crisis	5.994*	7.031*	8.907***	8.123**
	(3.281)	(4.002)	(2.728)	(3.710)
Savings	-1.520	0.793	2.424***	3.885***
	(1.185)	(1.426)	(0.629)	(0.964)
Bank deposits	-2.509	-4.557	0.002	-1.079
	(3.148)	(4.152)	(1.917)	(2.754)
Cash	-0.031	-2.748	0.545	0.181
	(3.269)	(3.869)	(2.066)	(3.181)
Lagged real rate	-0.040	-0.075	-0.008	-0.043
	(0.101)	(0.135)	(0.083)	(0.089)
Log of real GDP	-17.495***	-20.959***	-22.241***	-22.177***
	(5.827)	(6.484)	(3.212)	(3.596)
Log of prices	-9.186	-4.381	-2.854	-4.188
	(6.435)	(9.691)	(3.849)	(5.277)
Observations	134	124	208	182
R-squared	0.584		0.540	
AR2 test P-value		0.323		0.529
Number of country	20	20	20	20
Country FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

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

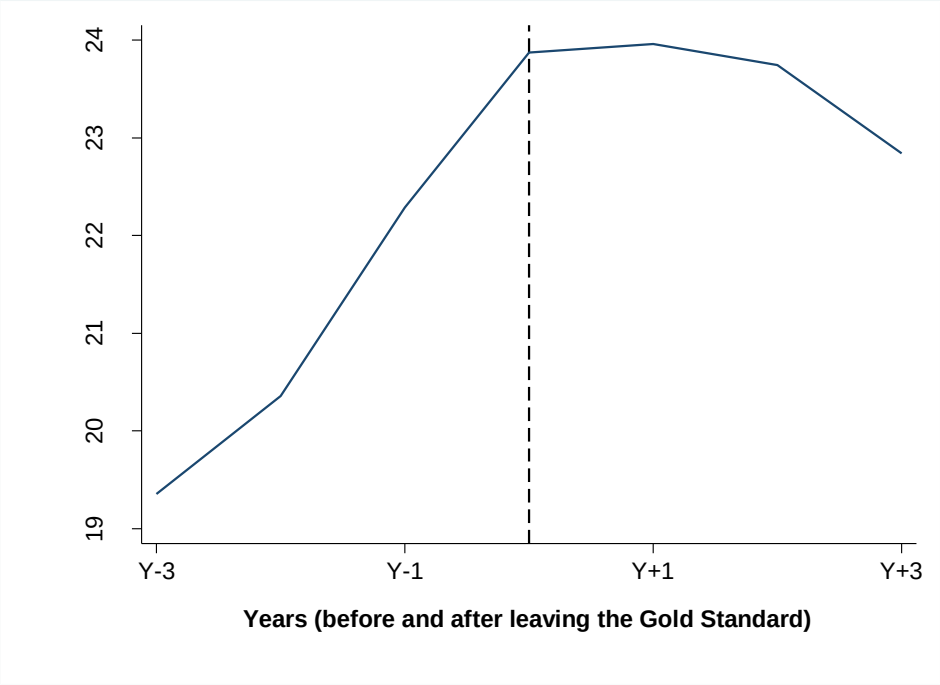
Notes: The dependent variable is the real long-term interest rate on government bonds. We exclude years when countries experienced a public debt crisis. All columns include interaction terms between a banking crisis dummy and deposits in savings institutions: (1) and (3) are estimated with OLS and (2) and (4) with GMM. In columns (1) to (2), the sample is the Great Depression (1929-1936) whereas columns (2) and (4) use similar specification on a larger interwar sample. All standard-errors are clustered at the country level and estimations include country-fixed and year-fixed effects.

Public policies and the paradox of thrift

Our work speaks directly to the current debate on the detrimental effects of excess savings since the 2008 crisis (Chamley 2012, Guerrieri & Lorenzoni 2017, Benigno & Fornaro 2018, Fornaro & Romei 2019, Challe 2020). One of the key questions

raised by these studies is: how should governments and central banks respond to the large increase in savings rates? The 1930s offer an interesting case study for anyone looking to answer this question.

FIGURE 4: RATIO OF SAVINGS INSTITUTIONS DEPOSITS TO NOMINAL GDP BEFORE AND AFTER LEAVING THE GOLD STANDARD.



Note: unweighted average of the data for the 17 countries for which we have nominal GDP data. Following Bernanke and James (1991), we define abandonment of the Gold Standard as occurring at the first date in which a country imposes exchange controls, devalues, or suspends gold payments.

Sources: see Appendix.

What kind of policy was likely to end the accumulation of precautionary savings during the Great Depression? According to the literature on the sources of economic recovery in the 1930s (Temin and Wigmore 1984, Romer 1992, Paolera and Taylor 1998, Eichengreen 2002 p27-28, Eggertsson 2008), leaving the Gold Standard proved to be the typical and most effective way for authorities to signal a change in policy, stabilize business and consumer expectations and thus to spur

growth. As can be seen in Figure 4, the ratio of savings to nominal GDP levelled off (and eventually decreased) once a country had left gold. We think the reason for this is straightforward. Abandoning the nominal anchor transformed expectations and pushed people to save a lower share of their wealth (therefore increasing consumption and investment), especially because leaving the gold standard was associated with countercyclical fiscal and monetary policies and the creation of unemployment insurance. Applied to today's situation, these lessons from the Great Depression suggest that a coordinated stabilization policy (as advocated by Fornaro and Romei 2019, p3777-3778) could be a way out of the paradox of thrift.

V. Conclusion

Following Keynes, a large literature emphasizes the importance of a fall in aggregate demand to explain the Great Depression. However, a missing piece in these studies was the fate of savings. Is there any evidence that savings increased at the expense of consumption? and, if so, how did household or firms saved? This paper has documented a significant increase in savings (both in nominal terms and as a percentage of GDP) in 22 countries, making it an important international feature of the Great Depression. The increase in savings and saving rate occurred through deposits in savings institutions (as well as in life insurances), especially in the years when banking crises hit. Hence, it is likely that uncertainty surrounding the mistrust in banks was a major cause in the surge of precautionary savings. The large sudden increase in savings associated by banking crises provides a way to identify a relatively exogenous shock on savings and assess its effect on real GDP. We have thus distinguished and tested two independent effects of banking crises: the conventional direct effect of a decrease in bank activity on economic growth, as well as an indirect effect through uncertainty and the rise in precautionary

savings. A back-of-the-envelope calculation suggests that these two effects of banking crises were of similar magnitude in 1930-1932 (and each explains about 15% of the total decrease in real GDP). Endogeneity issues are likely to underestimate the effect of precautionary savings, however. Our argument highlights an additional mechanism of the transmission and worsening of the Great Depression but does not explain why banking crises or the fall in output occurred in a first place.

These findings also raise a new important question for the political economy of the Great Depression. Since we now know where savings accumulated, it is worth asking if governments could have implemented targeted policies to decrease such precautionary savings or act on these institutions to channel savings in a different way.[16] Preliminary evidence shows that the exit from the gold standard was associated with a decrease in the savings-to-income ratio, but much remains to be written about the link between savings and recovery from the Depression. Whether these savings mostly came from households or firms, and if this phenomenon was associated with increasing wealth inequalities, also remain open questions. It is a promising area for further research. Despite hundred books and articles written about it, the Great Depression is still full of mysteries and new insights.

[16] See Baubeau et al. (2020) on France and Fleitas et al. (2020) on the US for studies following this line of research.

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Appendix

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Appendix A.

Data sources for banks, savings institutions, and life insurance companies

For deposit data, our main sources are national statistical yearbooks (produced by central banks or national statistical agencies). When these sources are not available, we turn to the League of Nations *Statistical Yearbook*(s). By tapping directly into the original publications, we avoid transcription errors which are frequent in secondary sources (Mitchell 2013 uses similar sources, but we noticed several occasions where he had misreported the data). Whenever possible, we improve and correct these series with recent estimations. For life insurance policy data, we also use national statistical yearbooks (except for France, where we rely on a secondary source). The sections below give a country-by-country overview of the sources used for commercial banks and savings banks deposits, and for life insurance policies.

Commercial banks deposits

Austria: *Statistische Handbuch für die Republik Osterreich* (various years). We add up savings account and current account deposits in the Aktienbanken (commercial banks) and the Landeshypothekenanstalten (public mortgage banks). Data for years 1920, 1921, 1922 and 1931 are not available. Million schillings.

Belgium: LoN *Statistical Yearbook*(s) (various years). All deposits of less than one-month notice in commercial banks. Starting in 1935, banks operating mainly in the Belgian Congo are included. Data for years 1930 and 1934 are not available. Million francs.

Bulgaria: LoN *Statistical Yearbook*(s) (various years). All deposits in popular banks, commercial banks and in the agricultural bank and central cooperative bank (state banks). Data before 1923 are not available. Million leva.

Denmark: *Statistisk Ärbog* (various years). Sum of current account and folio account deposits in commercial banks. Data for year 1920 is not available. Million kroner.

Finland: *Suomen Tilastollinen Vuosikirja* (various years). All deposits in commercial banks. Million markkaa.

France: Baubeau *et al* (2020). Million francs.

Germany: *Statistisches Jahrbuch für das Deutsche Reich* (various years). All deposits in commercial banks. Data before 1924 are not available. Million marks.

Greece: Lazaretou (2014). Million drachmas.

Hungary: Macher (2019). We add up deposit accounts in the issue banks and in the "other banks". Million pengos.

Italy: Natoli *et al* (2016). We add up deposits in the following banks: Societa ordinare di credito (SOC), Istituto di credito di diritto pubblico (ICDP), Istituto di credito di categoria (ICC), altre istituzione finanziarie (OUT), and altre banche (AB). Data for year 1926 is not available. Million liras.

Japan: *Hundred Years of Statistics of the Japanese Economy* (1966). Current deposits in private ordinary banks. Million yen.

Netherlands: LoN *Statistical Yearbook*(s) (various years). All deposits in the six main banks (including agencies and branches overseas). Million guilders.

Norway: Eitrheim *et al* (2004). Million kroner.

Poland: LoN *Statistical Yearbook*(s) (various years). Deposits in joint-stock banks, Polish branches of foreign joint-stock banks, Bank of the National Economy (excluding deposits of the government), Agricultural State Bank and two communal banks. Data before 1924 are not available. Million zlotys.

Portugal: LoN *Statistical Yearbook*(s) (various years). All deposits in commercial banks and special credit institutions. Data before 1924 are not available. Million escudos.

Romania: LoN *Statistical Yearbook*(s) (various years). All deposits in commercial banks. Million lei.

Spain: Acena and Pons (2005). Current account deposits in private banks. Data for year 1936 is not available. Million pesetas.

Sweden: *Statistisk Arsbok* (various years). Deposits by the public in private banks. Million kroner.

Switzerland: *Historische Zeitreihen die Banken in der Schweiz* (2007). Deposits in cantonal banks and big banks (excluding interbank deposits). Million francs.

United Kingdom: Cappie and Webber (1985). Current accounts deposits in clearing-banks, non-clearing banks, Irish banks, and Scottish banks. Data before 1922 are not available. Million pounds.

United States: Friedman and Schwartz (1963). Demand deposits in commercial banks (seasonally adjusted). Data or year 1936 is not available. Million dollars.

Yugoslavia: *Statisticki Godisnjak* (various years). All deposits in commercial banks. Million dinari.

Savings banks deposits

Austria: *Statistische Handbuch für die Republik Osterreich* (various years). Deposits in the postal savings bank and in the public savings banks. Data before 1925 are not available. Million schillings.

Belgium: *Annuaire Statistique de la Belgique et du Congo Belge* (various years).

Deposits at the Caisse Générale d'Epargne et de Retraite (CGER). Million francs.

Bulgaria: *Statističeski godišnik na Narodna republika Bãlgarija* (various years). Deposits at the postal savings bank. Million leva.

Denmark: *Statistisk Ärbog* (various years). Deposits in the private savings banks. Million kroner.

Finland: *Suomen Tilastollinen Vuosikirja* (various years). Deposits in the postal savings bank and in the private savings banks. Data for years 1935 and 1936 are not available. Million markkaa.

France: *Annuaire Statistique de la France* (various years). Deposits in the Caisse Nationale d'Epargne (CNE) and in the Caisses d'Epargne Ordinaires (CEO). Million francs.

Germany: *Statistisches Jahrbuch für das Deutsche Reich* (various years). Deposits in the public savings banks. Data before 1924 are not available. Million marks.

Greece: *Statistical Yearbook of Greece* (various years). Deposits at the postal savings bank. Million drachmas.

Hungary: *Magyar Statistikai Évkönyv*. Deposits in the postal savings banks and in the private savings banks. Data are only available for year 1930 and between 1932 and 1934 (included). Million pengos.

Italy: *Annuario Statistico Italiano* (various years). Deposits in the postal savings bank and in the casse di risparmio ordinarie (saving banks). Million liras.

Japan: *Hundred Years of Statistics of the Japanese Economy* (1966). Deposits in the postal savings banks and in the savings banks. Million yen.

Netherlands: *Nederlandse financiële instellingen in de twintigste eeuw: balansreeksen en naamlijst van handelsbanken* (2000). Deposits in the postal savings bank and in the algemene spaarbanken (general savings banks). Million guilders.

Norway: Eitrheim *et al* (2004). Deposits in the public savings banks. Million

kroner.

Poland: LoN *Statistical Yearbook*(s) (various years). Deposits in the postal savings bank and in the communal savings banks. Data before 1928 and after 1935 are not available. Million zlotys.

Portugal: LoN *Statistical Yearbook*(s) (various years). Deposits at the Caixa Geral de Depositos (national savings bank), excluding mandatory deposits. Data before 1926 are not available. Million escudos.

Romania: *Anuarul Statistic al Romanei* (various years). Deposits at the Cassa de Depuneri, Consemnatiuni si Economie (national savings bank). Million lei.

Spain: we follow Martinez (2008) by using the data from Acena (1985). Deposits in the postal savings bank and in the cajas de ahorro (savings banks). Million pesetas.

Sweden: *Statistisk Arsbok* (various years). Deposits in the postal savings bank and in the private savings banks. Million kroner.

Switzerland: *Statistisches Jahrbuch der Schweiz* (various years). Deposits in the private savings banks (Raiffeisen banks are not included). Data before 1928 and for year 1929 are not available. Million francs.

United Kingdom: Horne (1947). Deposits in the postal savings bank and in the Trustees Savings Banks (TSB). Data before 1923 are not available. Million pounds.

United States: Friedman and Schwartz (1963). Deposits in the postal savings bank and in the mutual savings banks. Data for year 1936 is not available. Million dollars.

Yugoslavia: *Statisticki Godisnjak* (various years). Deposits at the postal savings bank. Data before 1924 are not available. Million dinari.

Life insurance policies

Belgium: *Annuaire Statistique de la Belgique et du Congo Belge* (various years).

Life insurance policies at the CGER. Million francs.

Denmark: *Statistisk Ärbog* (various years). Life insurance policies in danish life insurance companies (includes public, joint-stock and mutual life insurance companies). Data for year 1920 is not available. Million kroner.

Finland: *Suomen Tilastollinen Vuosikirja* (various years). Life insurance policies in Finland. Million markkaa.

France: *Hautcoeur* (2004). Life insurance policies in french life insurance companies (reinsurance included). Million francs.

Germany: *Statistisches Jahrbuch für das Deutsche Reich* (various years). Life insurance policies in public life insurance companies. Data before 1924 are not available. Million marks.

Italy: *Annuario Statistico Italiano* (various years). Insurance policies at the National Insurance Institute (Istituto Nazionale delle Azicurazioni). Data for years 1920, 1921 and 1936 are missing. Million liras.

Japan: *Financial and Economic Annual of Japan* (various years). Life insurance policies at the post office and in private life insurance companies. Data for year 1936 is missing. Million yen.

Netherlands: *Jaarcijfers voor Nederland* (various years). Life insurance policies in Dutch life insurance companies (reinsurance included). Data between 1922 and 1924 (included) and for year 1936 are not available. Million guilders.

Norway: *Statistisk Ärbok* (various years). Life insurance policies in Norwegian life insurance companies. Data for year 1920, 1935 and 1936 are missing. Million kroner.

Spain: *Anuario Estadístico de España* (various years). Life insurance policies in Spanish life insurance companies. Data for year 1934 to 1936 (included) are missing. Million pesetas.

Sweden: *Statistisk Arsbok* (various years). Life insurance policies in Swedish life insurance companies (only includes policies subscribed in Sweden). Million

kroner.

Switzerland: *Statistisches Jahrbuch der Schweiz* (various years). Data for year 1936 is missing. Life insurance policies in Swiss life insurance companies. Million francs.

United Kingdom: *Statistical Abstract of the Bank of England* (various years). Data on life insurance policies were collected by the Board of Trade and published in yearly reports. Unfortunately, access to these reports is restricted. We therefore proxy life insurance policies by the total assets of life insurance companies. Data for year 1920 to 1923 (included) are missing. Million pounds.

United States: *Statistical Abstract of the US* (various years). Policies in force in all life insurance companies. Million dollars.

Appendix B

Data sources for other macroeconomic variables

Banknote circulation

Mitchell (2013). Mitchell uses the *Statistical Yearbook*(s) of the League of Nations or national statistical yearbooks. We checked and corrected Mitchell's data by going back to the original sources.

Dummy banking crisis

Bernanke and James (1991). For France, we coded the year 1932 as "non-crisis year", based on recent research by Baubeau *et al* (2020). For Spain, we coded the year 1931 as "crisis year" based on the work of Sotelo (2020). Portugal and Bulgaria are not covered by Bernanke and James, so we instead rely on Reinhart and Rogoff (2009) for Portugal, and on Kossev (2008) for Bulgaria.

Real GDP

Maddison project database (2018).

Nominal GDP

Bordo *et al* (2001).

Wholesale prices

Mitchell (2013).

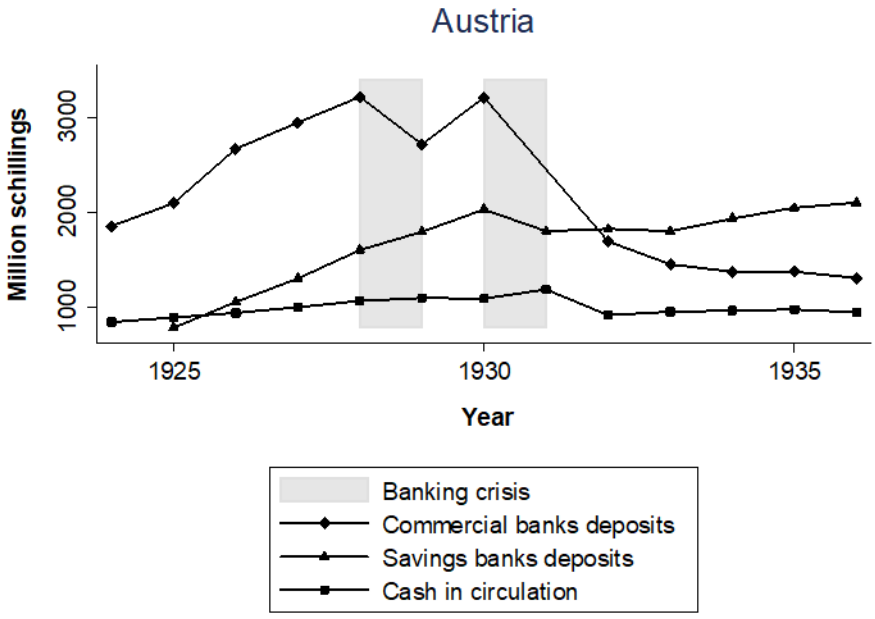
Long-term interest rates

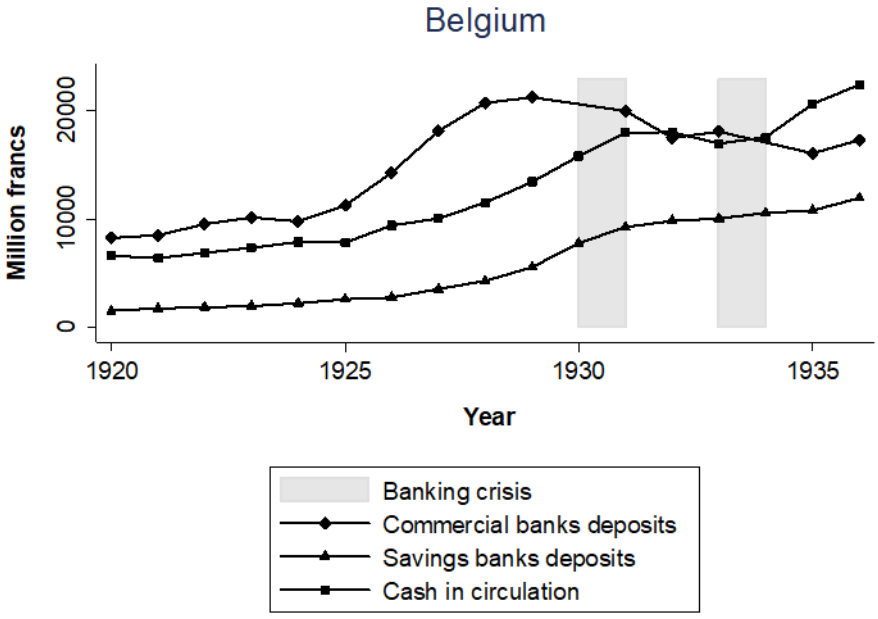
Jorda et al (2019). For Austria, Greece, Hungary, Poland, Portugal, Romania, and Yugoslavia, data are taken from the League of Nations *Statistical Yearbook*(s).

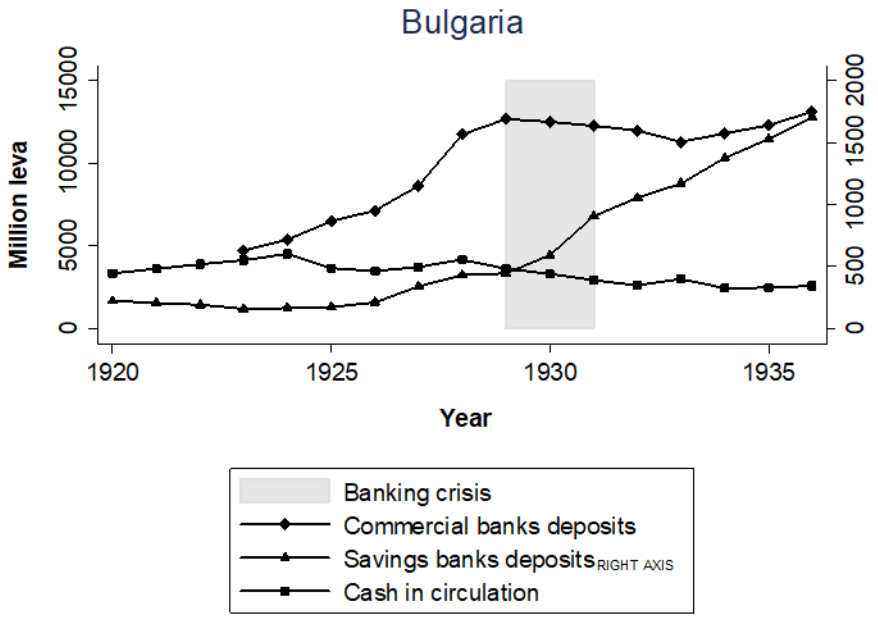
Appendix C

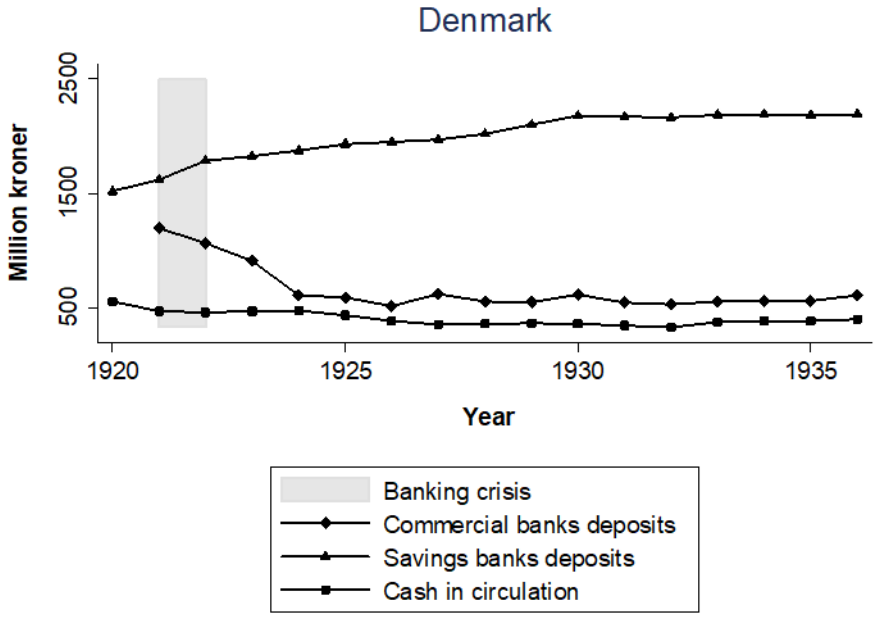
Individual country graphs

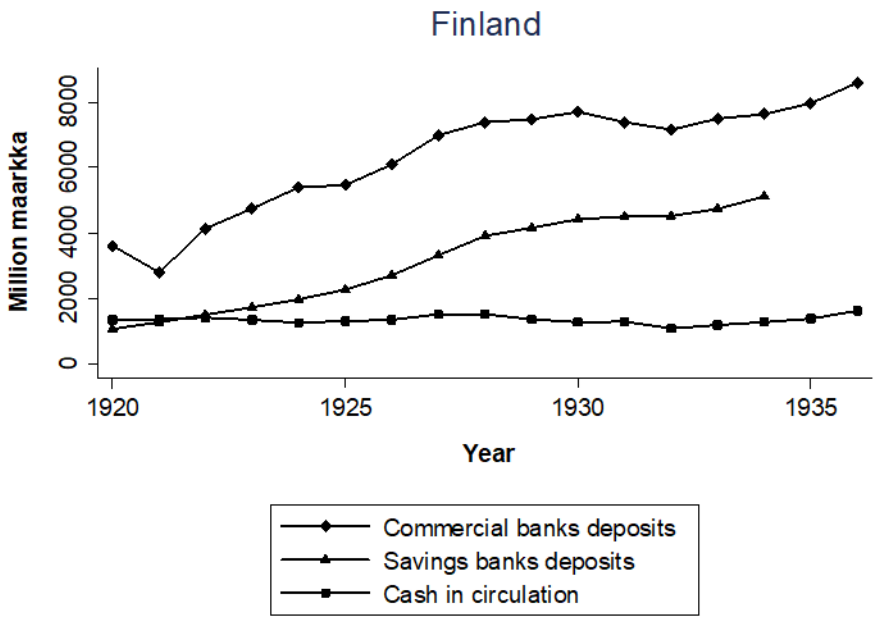
The following graphs plot the evolution of savings banks deposits, commercial banks deposits and cash in circulation, between 1920 and 1936, for each of the 22 countries in our sample. The shaded areas represent banking crisis periods, based on Bernanke and James (1991). For a crisis occurring in year Y, the shaded area starts in December of year Y-1 and ends in December of year Y (to show the evolution of the variables during year Y).

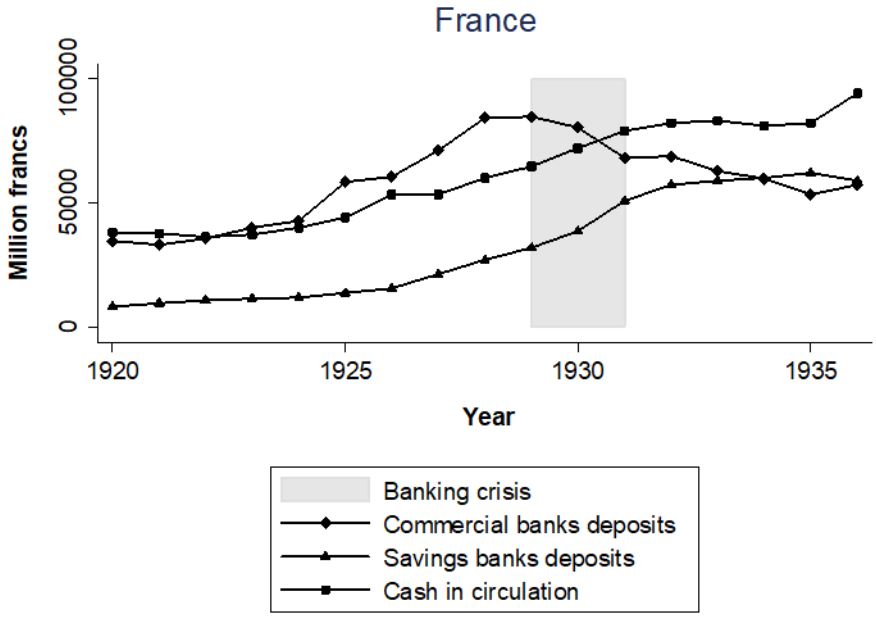


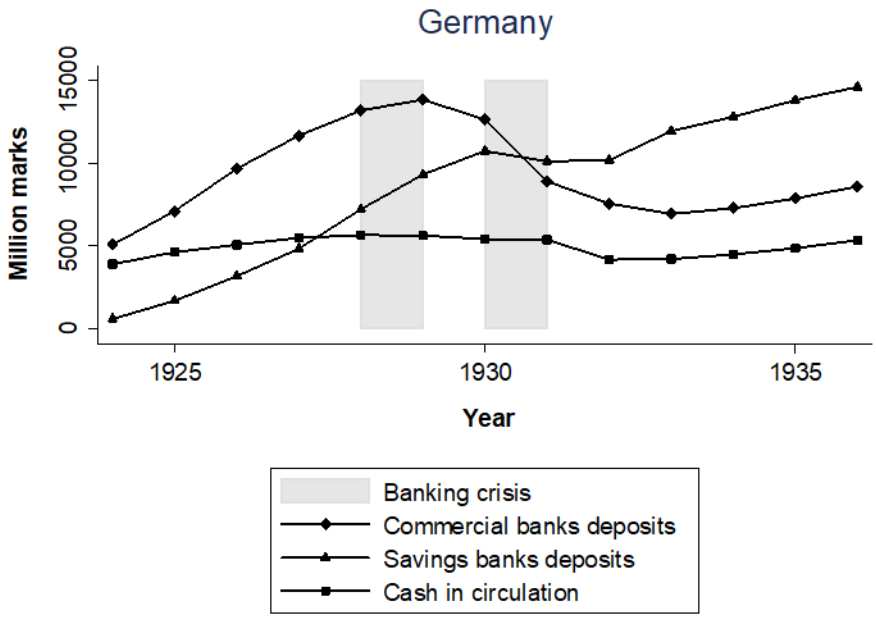

Belgium
Million francs
0
10000
20000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

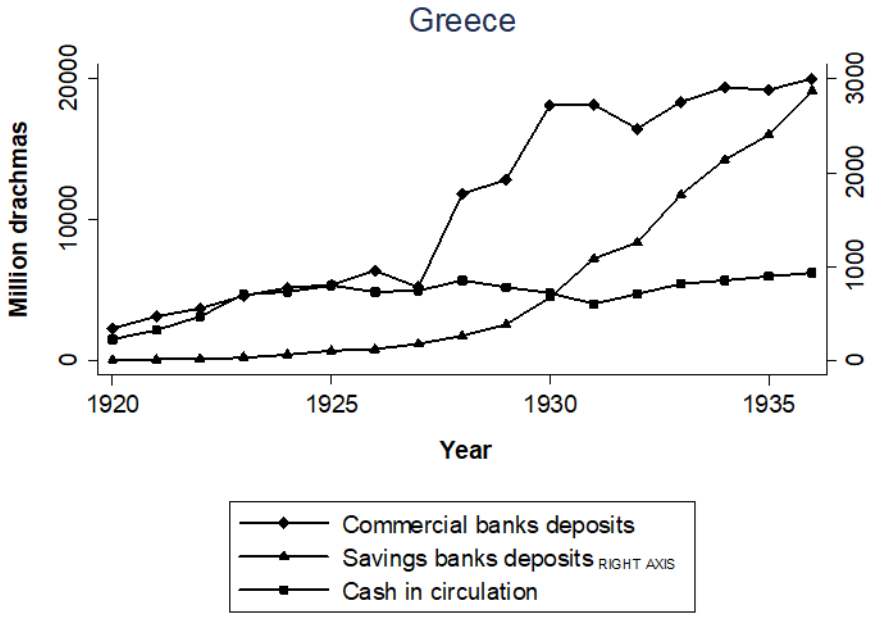

Bulgaria
Million leva
0
5000
10000
15000
0
500
1000
1500
2000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits RIGHT AXIS
Cash in circulation

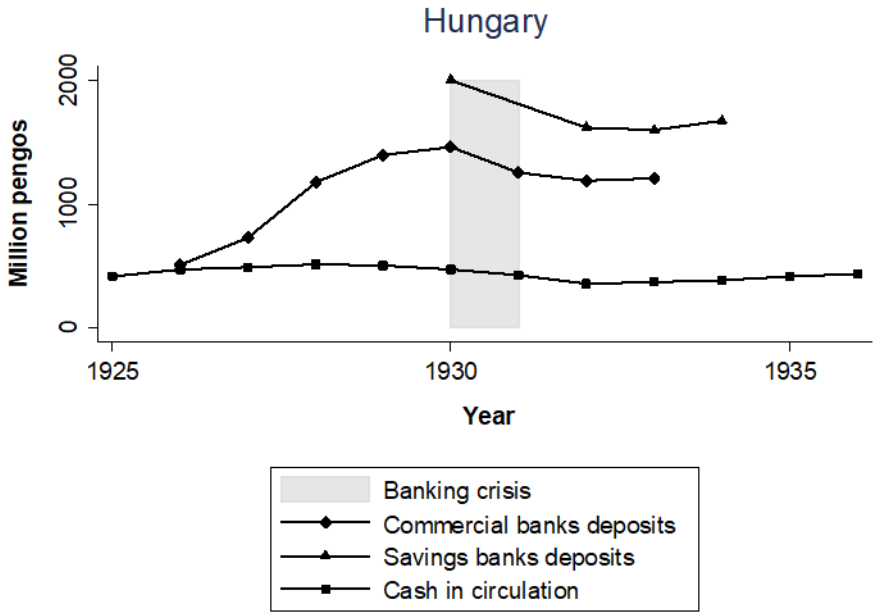

Denmark
Million kroner
500
1500
2500
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

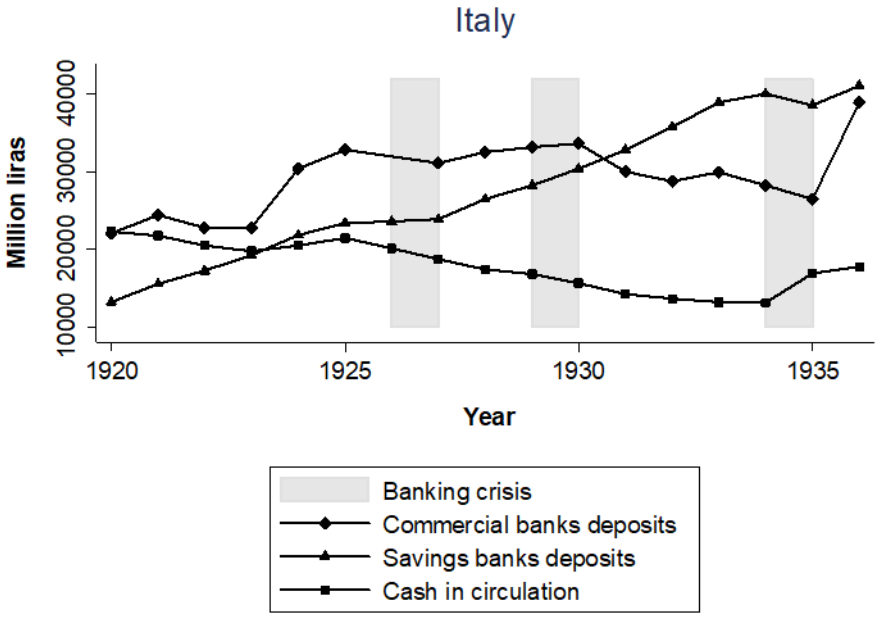

Finland
Million maarkka
0
2000
4000
6000
8000
1920
1925
1930
1935
Year
Commercial banks deposits
Savings banks deposits
Cash in circulation

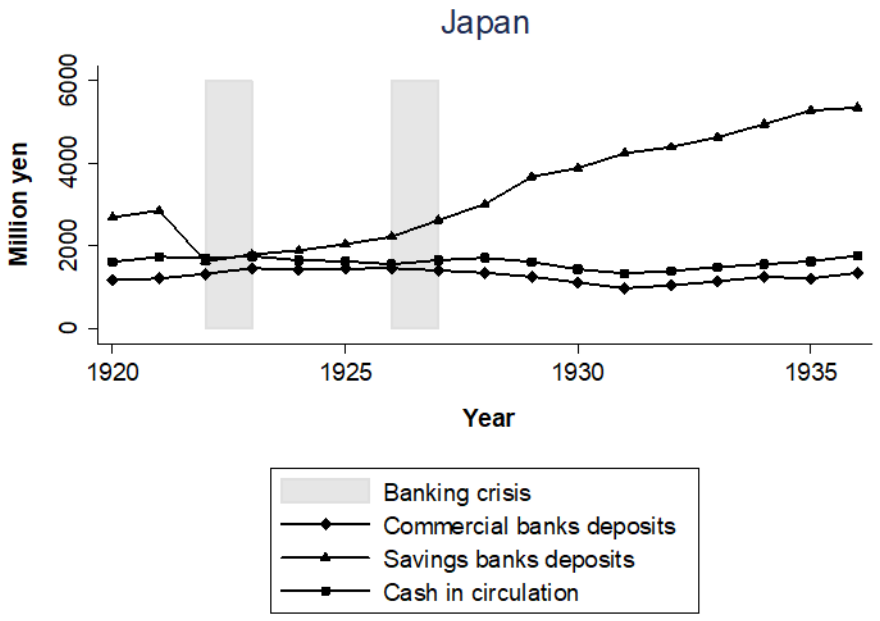

France
Million francs
0
50000
100000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

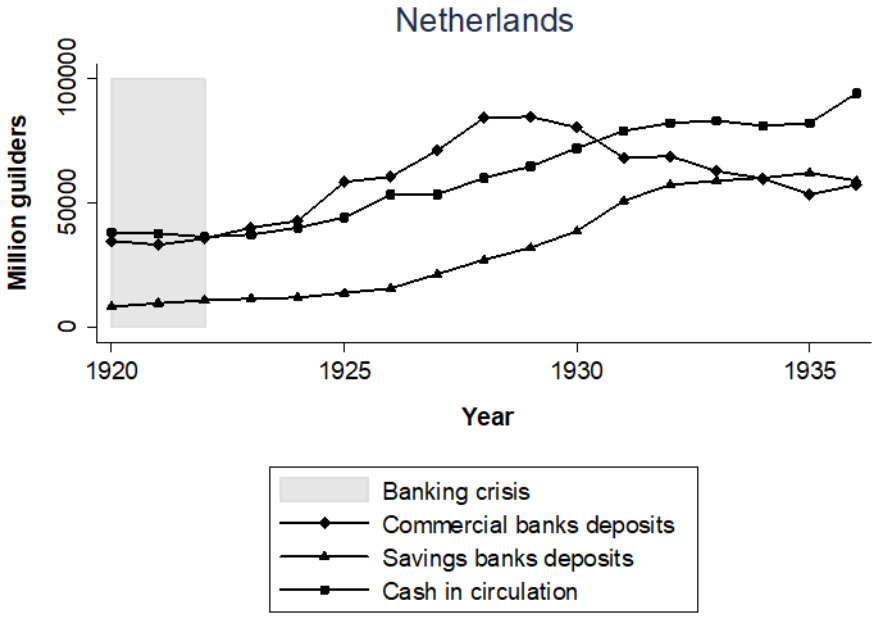

Germany
Million marks
0
5000
10000
15000
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

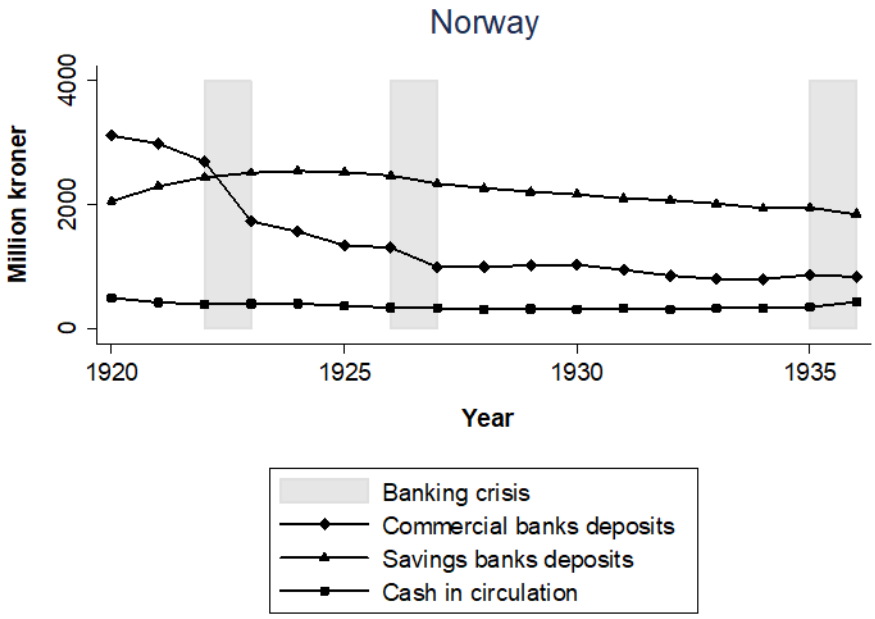

Greece
Million drachmas
0
10000
20000
0
1000
2000
3000
1920
1925
1930
1935
Year
Commercial banks deposits
Savings banks deposits RIGHT AXIS
Cash in circulation

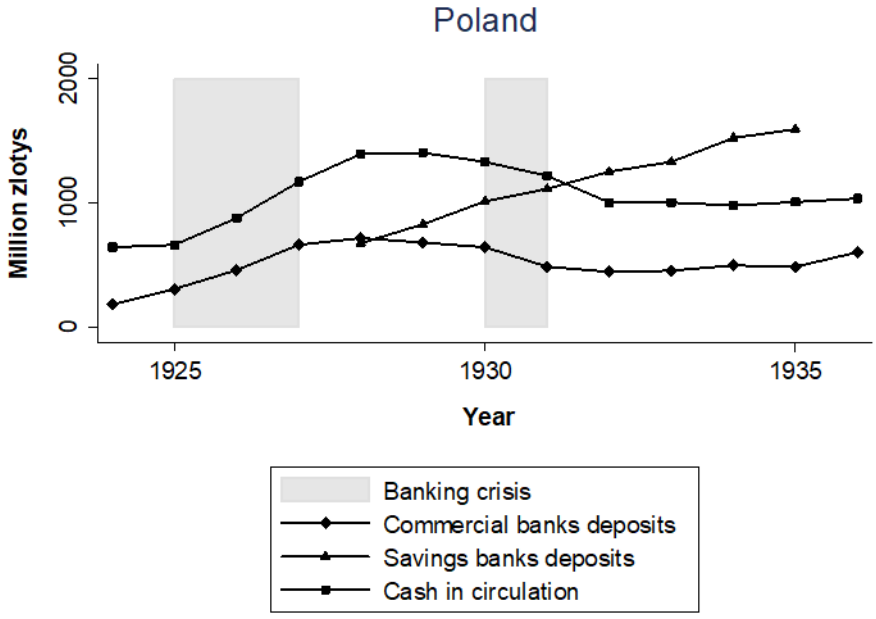

Hungary
Million pengos
0
1000
2000
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

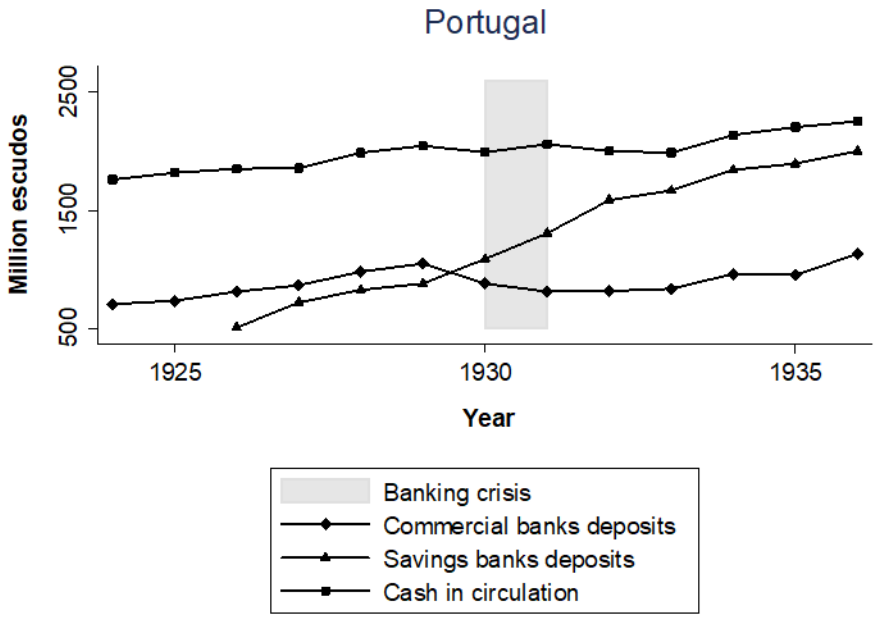

Italy
Million liras
10000
20000
30000
40000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

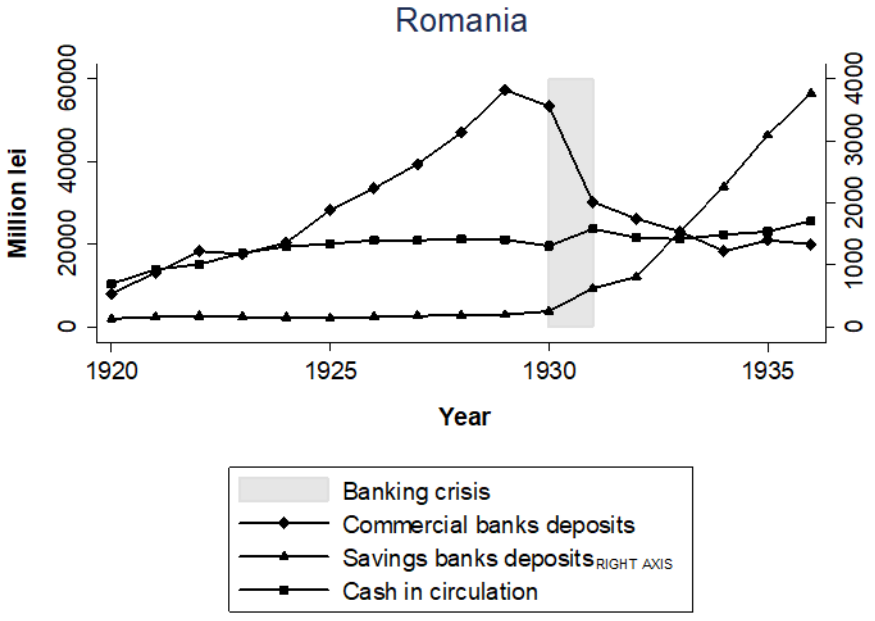

Japan
Million yen
0
2000
4000
6000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

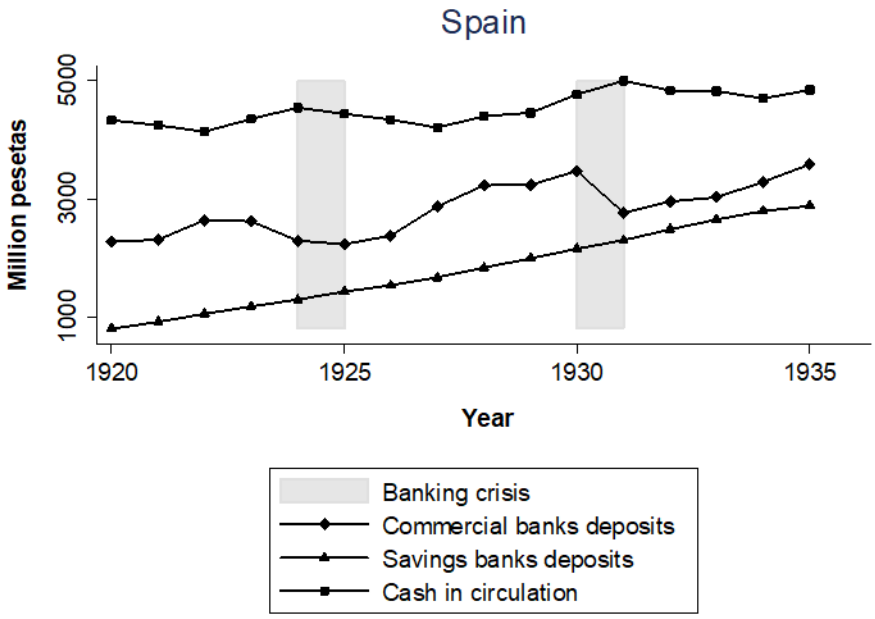

Netherlands
Million guilders
0
50000
100000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

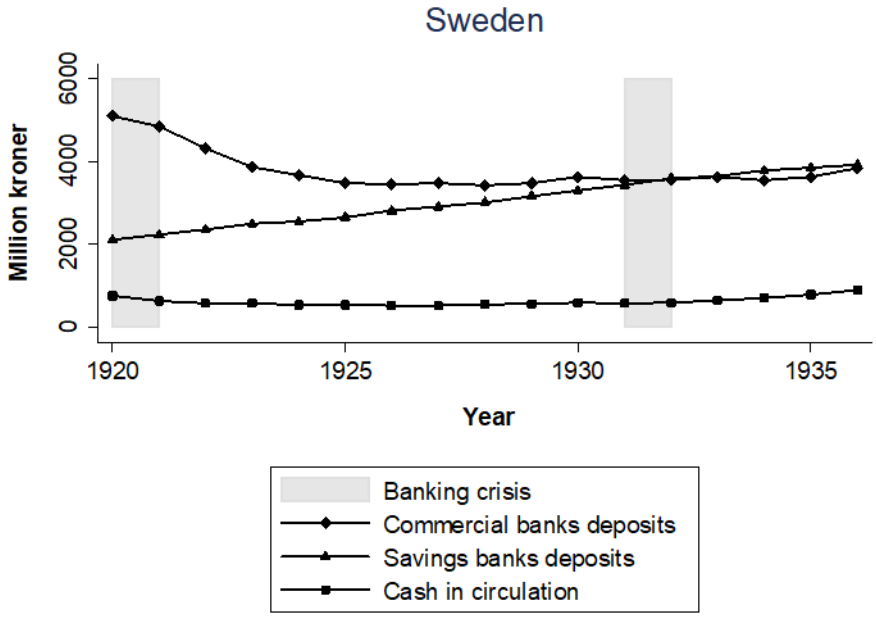

Norway
Million kroner
0
2000
4000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

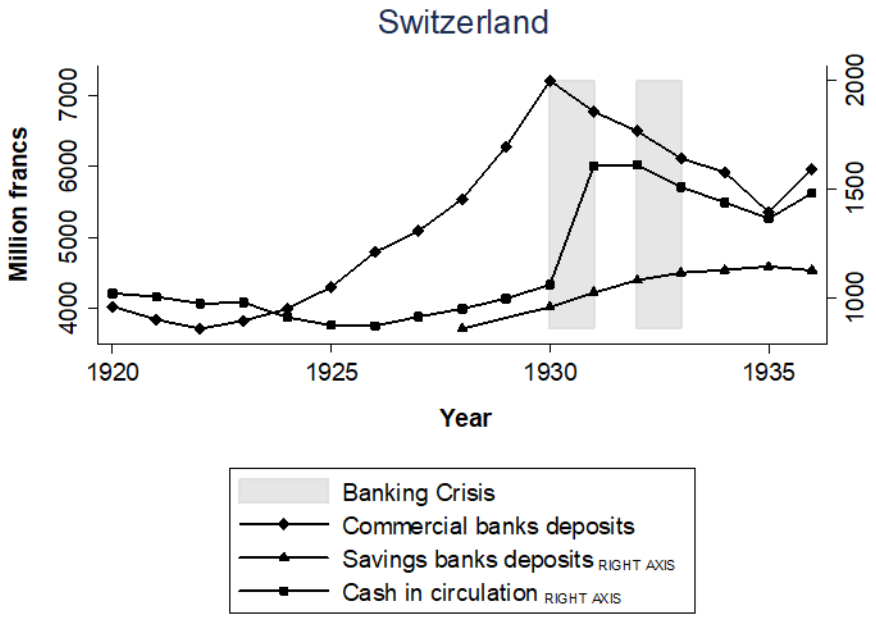

Poland
Million zlotys
0
1000
2000
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

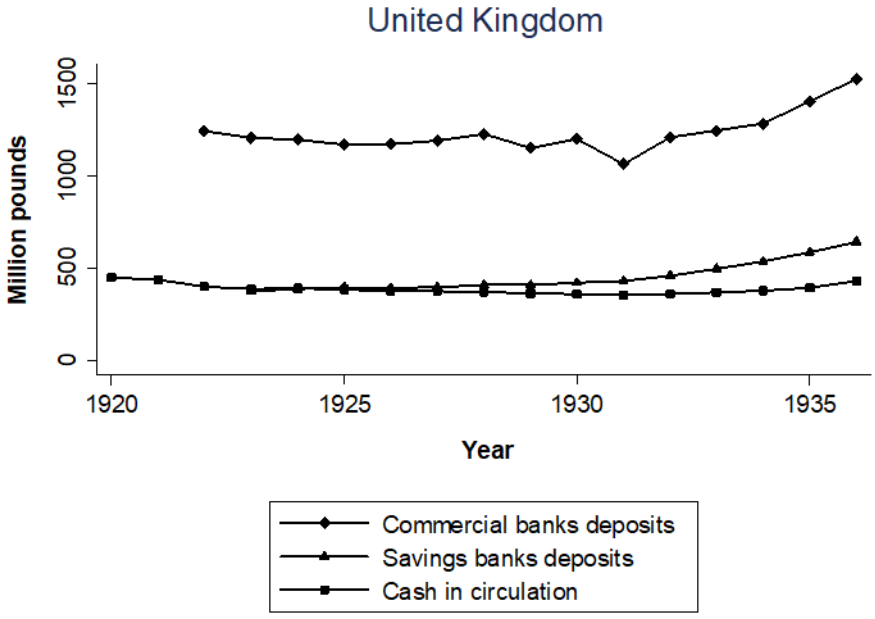

Portugal
Million escudos
500
1500
2500
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation

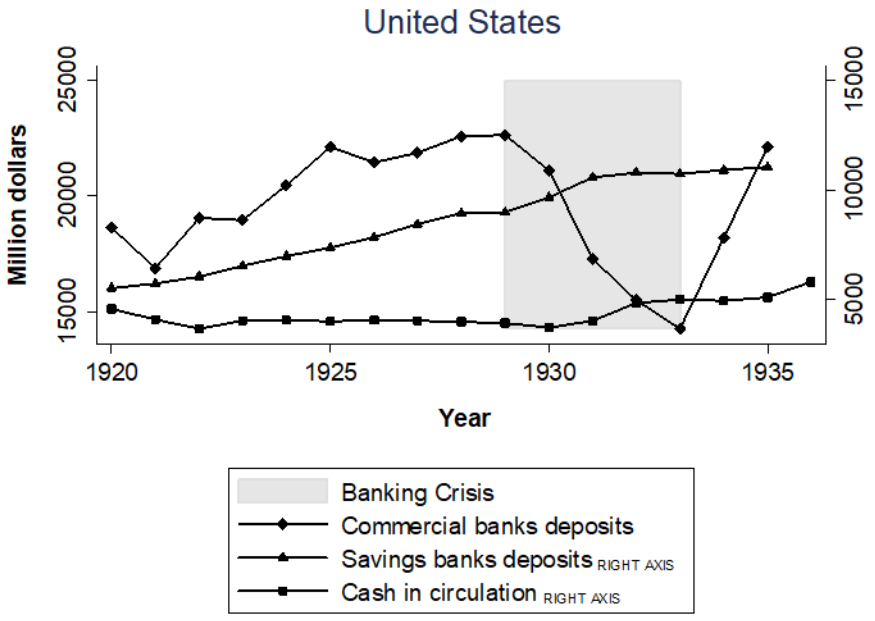

Romania
Million lei
0
20000
40000
60000
0
1000
2000
3000
4000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits RIGHT AXIS
Cash in circulation

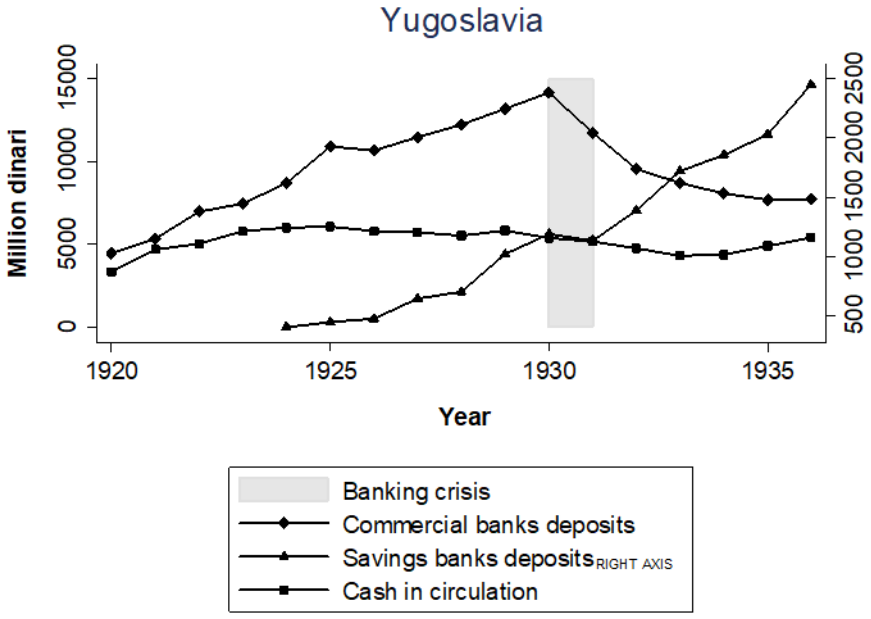

Spain
Million pesetas
1000
3000
5000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation


Sweden
Million kroner
0
2000
4000
6000
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits
Cash in circulation


Switzerland
Million francs
4000
5000
6000
7000
1000
1500
2000
1920
1925
1930
1935
Year
Banking Crisis
Commercial banks deposits
Savings banks deposits RIGHT AXIS
Cash in circulation RIGHT AXIS


United Kingdom
Million pounds
0
500
1000
1500
1920
1925
1930
1935
Year
Commercial banks deposits
Savings banks deposits
Cash in circulation


United States
Million dollars
15000
20000
25000
5000
10000
15000
1920
1925
1930
1935
Year
Banking Crisis
Commercial banks deposits
Savings banks deposits RIGHT AXIS
Cash in circulation RIGHT AXIS


Yugoslavia
Million dinari
0
5000
10000
15000
500
1000
1500
2000
2500
1920
1925
1930
1935
Year
Banking crisis
Commercial banks deposits
Savings banks deposits RIGHT AXIS
Cash in circulation