

# Who Collaborates with the Soviets? Financial Distress and Technology Transfer during the Great Depression

Jerry Jiang \*              Jacob P. Weber<sup>†</sup>

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## **Abstract**

We provide evidence that financial distress induces firms to sell their technology to foreign competitors. To do so, we build a novel, spatial dataset that locates U.S. firms who signed Technology Transfer Agreements (TTAs) with the Soviet Union during the 1920s and 1930s in various U.S. counties. By relating county-level measures of the number of TTAs signed to county-level measures of financial distress (bank failures), we establish a significant, positive relationship between financial distress and the number of firms signing TTAs with the Soviet Union.

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\*UC Berkeley

<sup>†</sup>Economics Department, UC Berkeley. Email: [jacob\\_weber@berkeley.edu](mailto:jacob_weber@berkeley.edu)

# 1 Introduction

We provide evidence that shocks to financial distress induce firms to sell their technology to foreign competitors. To do so, we build a novel dataset on the locations of U.S. firms who signed Technology Transfer Agreements (TTAs) with the Soviet Union during the 1920s and 1930s. We construct the dataset from lists of U.S. partner firms published by the Soviet Union during congressional inquiries and to advertise itself as a place to do business, researching each U.S. firm and locating it in a U.S. county. By relating our county-level measures of the number of TTAs signed to county-level measures of financial distress, measured using bank failures following Nanda and Nicholas (2014), we establish a significant, positive relationship between bank failures and the number of firms signing TTAs with the Soviet Union.

This paper helps resolve the historical question of why U.S. firms signed these contracts in the first place. Promised Soviet payments were small and often unrealized (Link, 2020), with no guarantee that the newly-established or improved Soviet plants and factories would not become competitors.<sup>1</sup> While historians have hypothesized that financial distress during the Great Depression and banking panics of the early 1930s drove desperate firms to sell their technology cheaply to foreigners, including the Soviet Union, this explanation is complicated by the fact that many firms signed TTAs prior to the U.S. stock market crash in late 1929. By bringing new, cross-sectional data to this old question, we show that financial distress does seem to induce firms to sign such contracts. Specifically, we find that hitting 1,000 US counties with a one-standard deviation increase in bank failures results in between one and eight additional TTAs signed nationwide (for reference, our sample of TTAs includes 172 signed by the Soviet Union during the 1920s and 1930s).

Our results have important implications for policymakers in both developing and developed economies today. While there is considerable empirical work demonstrating that technology transfer benefits *receiving* firms, there is no work to our knowledge that quantitatively investigates the incentives of *sending* firms to help set up foreign competitors.<sup>2</sup> Thus, despite the desirability of such contracts, there is little formal empirical work to guide policymakers in de-

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<sup>1</sup>Though signing firms did try to limit future competition: Ford Motor Company, when re-negotiating their technology transfer agreement with the Soviet Union in 1935, stipulated that the Soviet Union must refrain from exporting their home-made vehicles (Link, 2020).

<sup>2</sup>See Giorcelli (2019), which studies the impact of US technology transfers to Italy as part of the Marshall Plan, and Giorcelli and Li (2023) for Soviet transfers to China during the 1950s. In the first of his three-volume work on the importance of western technology in Soviet economic development, Sutton (1968) argues from qualitative evidence and correlations that the TTAs we study were critical to Soviet development in the 1920s and 1930s.

veloping countries in terms of where to search for partners in developed countries. We provide a historical case study to help fill this gap, showing economic incentives (financial distress), along with cultural affinity, affect firms’ willingness to transfer technology and do business with even foreign countries that may be politically hostile to their home country.

For policymakers in developed economies, our results point to a novel and overlooked potential cost of allowing banks to fail when the customers of those banks are innovative firms and individuals (as in the case of the recent failure of Silicon Valley Bank in the United States). We provide the first evidence that bank failures leave technologically advanced firms vulnerable to “poaching” from hostile foreign governments. To the extent that this is viewed as undesirable, for e.g. national security or other reasons, this finding may provide some rationale for rescuing banks that serve firms and workers who have access to valuable proprietary technology, and potentially for subjecting such banks to greater regulatory oversight.

The rest of the paper proceeds as follows: Section 2 describes the historical context, and Section 3 describes the construction of our dataset from historical lists of TTAs. Section 4 demonstrates both that financial distress matters for firms’ willingness to sign TTAs, and also that cultural affinity matters as well. Section 5 concludes.

## 2 Historical Context

In 1917, shortly after the Bolshevik Party seized power in the “October Revolution,” the United States broke off diplomatic relations with Russia. The United States would not formally recognize the Soviet Union diplomatically until November of 1933, when Roosevelt sought to stimulate trade and serve U.S. commercial interests in the Soviet Union, which were—by that point—substantial.

U.S. firms conducted business with the Soviet Union during this time despite considerable risk. After World War One, the Soviet leadership determined that foreign equipment and expertise was needed to stabilize their teetering postwar economy and eventually industrialize. Concession agreements of the early 1920s, in which foreign firms were invited to establish factories or other facilities in the Soviet Union, frequently ended in expropriation. Once this unfortunate tendency became apparent to foreigners, the Soviet Union began a more direct, transactional approach to acquiring technology, in which they paid outright for help copying production processes already used in the United States (Sutton, 1968). It is these “Technology

Transfer Agreements” (TTAs) to which we restrict attention.<sup>3</sup>

These agreements were concluded by the Soviet government directly with U.S. firms, and involved the exchange of personnel (foremen and engineers to supervise and train Soviet workers, and training trips for Soviet engineers in the United States), help acquiring the necessary equipment, and complete access to any and all patents, blueprints, and other proprietary “intangible assets.” The Soviets paid directly for these services, which were arguably critical to its industrial development; see Sutton (1968) for a general overview of Soviet attempts to acquire Western Technology, and Link (2020) for a thorough discussion of the case of Ford Motor Company.

Even with these agreements, U.S. firms took on considerable risk both that the Soviet Union would renege on promised payments, as Ford discovered in the 1930s (Link, 2020), and that workers sent abroad would be arrested.<sup>4</sup> Moreover, these firms took on political risk at home, given the U.S. public’s fear of the Soviet Union, manifested most clearly in the Red Scare of 1919-1920. Accordingly, the Soviet Union took considerable pains to burnish its image among U.S. industrialists, and published lists of firms who had entered into agreements in publications such as the *Economic Review of the Soviet Union*. Thus, although many countries were signing TTAs and attempting to adopt U.S. Technology at this time (Germany, Japan, etc.), the Soviet Union presents a unique opportunity to study TTAs at scale due to its uniquely bad public image problem in the United States, as it is these lists that allows us to create our dataset.

### 3 Constructing the TTA Dataset

We compile a list of all U.S. firms which signed TTAs with the Soviet Union using individual lists published by the Soviet Union to advertise its business with U.S. firms.<sup>5</sup> Our sources include Bron (1930); publications of the *Economic Review of the Soviet Union* in July 1929 and April 1930; and proceedings from an anti-communist, Congressional “Investigation of Communist Propoganda in the United States” (specifically, the “Bogdanov Papers” therein) in 1930 as well

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<sup>3</sup>Technology Transfer Agreements were signed primarily, though not exclusively, with the United States. German firms were also an important source of these agreements at first, though over the course of the 1920s the Soviet Union began to turn increasingly towards American firms (Sutton, 1968).

<sup>4</sup>Consider, e.g., the Shakhta affair of 1929 in which five German engineers were jailed and accused of “counter revolutionary” activities; Sutton (1968) relates that the U.S. State Department archives contain a number of foreign government reports establishing the arrests as politically motivated by a fear that the dominant place achieved by the Germans in Russian industry threatened the hold of the Party.

<sup>5</sup>Our list is almost certainly not exhaustive, but in practice the Soviet Union publicized most agreements; though it often worked to hide subsequent negative news coverage, going so far as to criminalize any negative report regarding agreements with foreign firms in 1925 (Sutton, 1968)

as lists provided in Sutton (1968) and Sutton (1973). These lists collectively name 172 firms and usually describe the technology being transferred. While some firms may have signed multiple agreements at different points in time, these lists only indicate which firms have signed at least one agreement; as they name firms, and not individual unique contracts, they do not usually provide exact dates each TTA was signed.<sup>6</sup>

We then determine where each firm was located. While some firms are large and well-studied (e.g. Ford Motor Company) most are not. For small firms, we use industry or trade publications, patent records, the Bogdanov papers, and other sources to establish locations. For multi-establishment firms, we associate the firm's location with the location of its headquarters (e.g. Detroit, for Ford Motor Company). In this way, we are able to do successfully locate 128 of the 172 firms that signed TTAs in 64 US counties, plotted in Figure 1.

In the regressions that follow, we also compute a measure of financial distress from annual FDIC data on bank suspensions from ICPSR following Nanda and Nicholas (2014). This and other demographic information from the 1930 U.S. Census were downloaded from IPUMS NHGIS.

## 4 Results

This section explores the determinants of TTA agreements using county level data. From Figure 1, we can see that many counties never sign a TTA, and that they are correlated across space. To investigate the county-specific features that are associated with a propensity to sign a TTA with the Soviet Union, we estimate the following regression:

$$\mathbf{1}(\text{County } i \text{ has a TTA}) = \beta X_{i,1930} + \epsilon_i \quad (1)$$

Equation (1) describes linear probability model wherein the left hand side is a dummy variable taking on the value of 1 if County<sub>i</sub> has at least one TTA, where  $X_{i,1930}$  is a vector of county-specific demographic variables computed from the 1930 census. Table 1 displays the resulting estimates for  $\beta$ , demonstrates that populous, literate counties with a high share of Russian nationals were more likely to have TTAs. While the controls investigated in Table 1 are not an exhaustive list of the determinants of TTA agreements, the results suggest that there are important (and perhaps unobservable) county-specific features that make some places more

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<sup>6</sup>The Bogdanov Papers are a useful exception.

likely to sign TTAs with the Soviet Union than others. This motivates our construction of a county panel dataset with a rough time dimension, permitting estimation of county fixed effects, when investigating the role played by financial distress in inducing firms to sign TTAs.

To investigate whether financial distress led firms to sell their technology to the Soviet Union, we use TTA lists published at different dates to determine whether a particular firm signed its first TTA before or after the stock market crash.<sup>7</sup> We then build a panel dataset with two periods: before and after the great crash, where we have for each county a measure of TTAs signed and financial distress in each period, measured using bank failures following Nanda and Nicholas (2014).

Specifically, to measure financial distress we construct a variable that measures the number of bank failures in county  $i$  as a share of existing banks for each of the two business cycles split by the stock market crash of 1929:  $t = 0$  or  $t = 1$  ( $\text{Share of Banks Failing}_{i,t}$ ) using annual FDIC data from IPUMS NHGIS as follows:

$$\begin{aligned}\text{Share of Banks Failing}_{i,0} &\equiv \frac{\text{Total Banks Suspended in } i \text{ in years 1927, 1928, and 1929}}{\text{Total Banks Operating in year 1926}} \\ \text{Share of Banks Failing}_{i,1} &\equiv \frac{\text{Total Banks Suspended in } i \text{ in years 1930, 1931, 1932, and 1933}}{\text{Total Banks Operating in year 1929}}\end{aligned}$$

The variable  $\text{Share of Banks Failing}_{i,1}$  is identical to that used by Nanda and Nicholas (2014); the years 1926 and 1929 are business cycle peaks (Q3 of each year, specifically) and so we have here also computed an analogous measure for the much milder business cycle prior to the Great Contraction of 1929 to 1933, unlike those authors.<sup>8</sup>

Ideally, we would next create a county-specific measure of firms signing TTAs during each business cycle as our dependent variable,  $\text{TTAs}_{i,t}$ , excluding TTAs that were signed outside of the two business cycles indicated by  $t = 0$  or  $t = 1$ . However, we don't generally have the exact date each firm signed, as discussed above.

To proceed, we first determine whether or not a TTA was signed before or after the great crash of 1929 by looking at when a firm first appears in the TTA lists we have at various dates. This effectively establishes whether a TTA was signed in the 1920s, or in the 1930s. To then exclude TTAs signed outside of these two business cycles, we then restrict attention to TTAs

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<sup>7</sup>We also make use of individual dates for TTA agreements, when available, though these are generally available only for agreements which happen to be included in the Bogdanov papers or which have been researched individually by historians.

<sup>8</sup>Bank suspensions are not technically bank failures, as some banks that suspend operations may eventually reopen; however, Calomiris and Mason (2003) argue that this distinction does not make a substantive difference when identifying bank distress empirically, and we abstract from it in discussion here for simplicity.

associated with the first Soviet Five Year Plan, which lasted from 1928 to 1932, which can often be established using secondary sources even when an exact date is not available; since in practice most TTAs signed during the interwar period were associated with this five year plan (Sutton, 1968), this yields a measure for  $\text{TTAs}_{i,t}$  that includes only contracts signed during  $t$ , at the cost of eliminating some contracts signed e.g. in 1927 or 1933.

Table 2 estimates the total number of TTAs signed during the First Soviet Five Year Plan (1928-1932) by US Firms in county  $i$  at time  $t$  as a linear function of county-level banking distress measured following Nanda and Kerr (2014). Two time periods permits estimation of county fixed effects  $\gamma_i$ . The regression specification is then

$$\text{TTAs}_{i,t} = \gamma_i + \beta_0 \text{Share of Banks Failing}_{i,t} + \epsilon_{i,t}. \quad (2)$$

All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation. Column (1) of in Table 2 presents the estimate of  $\beta_0$ , which demonstrates a significant, positive effect of banking failures on the number of TTAs signed in a county. The resulting estimate of .007 implies that hitting 1000 US counties with a one-standard deviation shock to financial distress generates 7 additional TTAs nationwide (i.e. .007 per county, on average).

We also estimate specifications in which we allow banking failures to have different effects in the cross section of each business cycle, investigating the extent to which the results are driven by the massive (and perhaps unusual) wave of banking failures during the Great Contraction and banking panics of 1929-1933. To do so, we estimate the following two specifications:

$$\begin{aligned} \text{TTAs}_{i,t} = & \gamma_i + \beta_1 \mathbf{1}(t = \text{pre-Crash}) \text{Share of Banks Failing}_{i,t} \\ & + \beta_2 \mathbf{1}(t = \text{post-Crash}) \text{Share of Banks Failing}_{i,t} + \epsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned} \text{TTAs}_{i,t} = & \gamma_i + \beta_1 \mathbf{1}(t = \text{pre-Crash}) \text{Share of Banks Failing}_{i,t} \\ & + \beta_2 \mathbf{1}(t = \text{post-Crash}) \text{Share of Banks Failing}_{i,t} + \tau_t + \epsilon_{i,t} \end{aligned} \quad (4)$$

Table 2's columns (2) and (3) estimate equations (3) and (4), respectively, which allow banking distress to have different marginal effects ( $\beta_1$  and  $\beta_2$ ) during the two different periods. Note that equation (4) simply adds time fixed effects to equation (3). After adding the time fixed effect, the results in Column (3) demonstrates that, conditional on all counties being hammered by

the mass banking failures in the early 1930s, marginal differences across counties do not matter at all for determining where TTAs are signed, but that differences in financial distress across counties did matter in the pre-period before the crash (1927-1929). These estimated effects remain economically modest; note that a coefficient of .005 would imply that hitting 1000 US counties with a one-standard deviation shock to financial distress generates 5 additional TTAs nationwide (i.e. .005 per county, on average).

## 5 Conclusion

This paper provides the first quantitative evidence that U.S. firms were induced to sell their proprietary technology to the Soviet Union by local financial distress during the interwar period, as historians have suggested. Specifically, by building a novel dataset on the locations of the various firms which signed Technology Transfer Agreements with the Soviet Union, we showed that counties with a large share of banks failing also saw more firms signing such agreements. These results controlled for county-specific fixed effects, as we also found that county specific features like population size, literacy rates, and the share of Russian nationals were important determinants of where Technology Transfer Agreements were signed.

To the extent that developing economies continue to make use similar agreements, our results have important implications for modern policymakers. For policymakers in developing countries, we provide the first empirical guidance on where to look for private sector partners when importing technology from other countries. For policymakers in developed countries, our results point to a novel potential cost of banking panics when the customers of a failed bank include firms with valuable proprietary technology: financial distress induced by bank failures may leave firms vulnerable to “poaching” by hostile foreign governments. To the extent that a policymaker may wish to avoid this, the results here suggest an additional motivation for rescuing such banks or subjecting them to greater regulatory oversight.

## Where Did Firms Sell Technology to the Soviet Union?

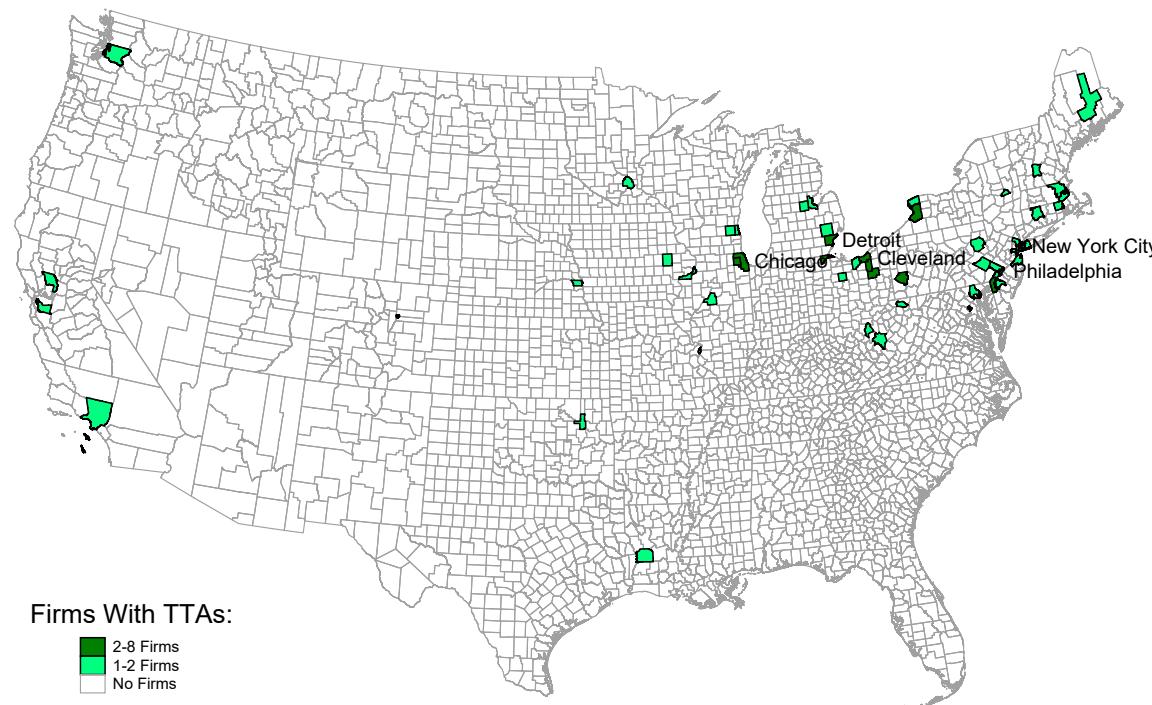


Figure 1: Spatial distribution of Technology Transfer Agreements (TTAs) signed with the Soviet Union in the interwar period.

Table 1: Populous, Literate Counties With Many Russian Nationals Were More Likely to Have Technology Transfer Agreements (TTAs) With the Soviet Union

	(1) Probability A County Has a TTA
Log Population	0.058*** (0.012)
Log Manufacturing Establishments	0.006 (0.007)
Russian Share of Population	0.032* (0.015)
Urbanization Rate	-0.002 (0.003)
Manufacturing Employment Share	0.004 (0.005)
Literacy Rate	0.006* (0.002)
Observations	2470

*Notes:* Point estimates of a linear probability model which estimates the probability that a given county has at least one firm with a TTA as a function of county characteristics taken from the 1930 US Census, revealing that counties with TTAs are larger in population, have a higher share of Russian Nationals, and are generally more literate. Coefficients are normalized by each variable's standard deviation, so that e.g. a one standard deviation increase in the Russian population share raises the odds that a county has a firm with a TTA by 3.2%. Standard errors in parentheses, clustered by U.S. State.

Stars indicate: \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$

Table 2: Local Financial Distress Induces U.S. Firms To Sign Technology Transfer Agreements (TTAs) With the Soviet Union

This table estimates the total number of TTAs signed by US Firms in county  $i$  at time  $t$  as a linear function of county-level bank failures measured as in Nanda and Kerr (2014). Lacking specific dates that contracts were signed,  $t$  is measured coarsely as the period 1927-1929 (pre stock market crash) or 1930-1933 (post crash); two time periods permits estimation of county fixed effects  $\gamma_i$ . The regression specifications for each column are:

$$TTAs_{i,t} = \gamma_i + \beta_0 \text{Share of Banks Failing}_{i,t} + \epsilon_{i,t} \quad (\text{Col. 1})$$

$$TTAs_{i,t} = \gamma_i + \beta_1 \mathbf{1}(t = \text{pre-Crash}) \text{Share of Banks Failing}_{i,t} + \beta_2 \mathbf{1}(t = \text{post-Crash}) \text{Share of Banks Failing}_{i,t} + \epsilon_{i,t} \quad (\text{Col. 2})$$

$$TTAs_{i,t} = \gamma_i + \beta_1 \mathbf{1}(t = \text{pre-Crash}) \text{Share of Banks Failing}_{i,t} + \beta_2 \mathbf{1}(t = \text{post-Crash}) \text{Share of Banks Failing}_{i,t} + \tau_t + \epsilon_{i,t} \quad (\text{Col. 3})$$

All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.

Columns (2) and (3) allow banking distress to have different marginal effects ( $\beta_1$  and  $\beta_2$ ) during the two different periods. Column (3) demonstrates that, conditional on all counties being hammered by the mass banking failures in the early 1930s, marginal differences across counties do not matter for determining where TTAs are signed, but that differences in financial distress across counties did matter in the pre-period before the crash. These estimated effects are economically modest: a coefficient of .005 would imply that hitting 1000 US counties with a one-standard deviation shock to financial distress generates 5 additional TTAs nationwide (i.e. .005 per county, on average).

	(1) Total TTAs Signed	(2) Total TTAs Signed	(3) Total TTAs Signed
Share of Banks Failing	0.007* (0.003)		
Share of Banks Failing 1927-1929		0.001 (0.001)	0.006* (0.002)
Share of Banks Failing 1930-1933		0.008** (0.003)	-0.000 (0.003)
Post Crash Dummy (Time Fixed Effect)			0.019* (0.008)
Observations	5940	5940	5940

*Notes:* Standard errors in parentheses, clustered by U.S. State. Dependent variable is the total number of TTAs signed. All regressions include county fixed effects. Stars indicate: \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$

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