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Abstract

We provide evidence that financial distress induces firms to sell their technology to foreign competitors. To do so, we construct a novel, spatial panel dataset by individually researching and locating 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 the number of TTAs signed in each county to the number of bank failures, we establish a significant, positive relationship between financial distress and the number of firms signing TTAs with the Soviet Union. Our findings suggest that banking panics may create opportunities for foreign countries to acquire affected firms' technology.

JEL classification: G21, N6, O33
Key words: banking panic, technology assistance, know-how diffusion, industrialization, industrial policy

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1 Introduction

Developing economies frequently seek to acquire technology from private firms in developed economies through Technology Transfer Agreements (TTAs)[1] in order to speed economic development. The existing economics literature validates this interest by showing that TTAs can greatly benefit receiving firms (e.g., Giorcelli and Li, 2023; Giorcelli, 2019; Van Reenen and Yueh, 2012; Sutton, 1971, 1968). However, no existing study quantitatively investigates the incentives of sending firms in developed countries to sign TTAs and sell their technology to foreigners, leaving policymakers in developing economies with no formal, empirical guidance on where to search for partner firms.

This paper investigates the factors which drive domestic firms to sign TTA agreements and sell their technology to foreigners. By studying the agreements signed between U.S. firms and the Soviet Union during the interwar period, we find that both local financial distress and cultural affinity with the foreign, receiving country make it more likely that firms will sign TTAs.

To establish these facts, we construct a novel, spatial panel dataset on the locations of U.S. firms who signed 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, researching each individual contract to determine when it was likely signed and which U.S. city the signing firm was located in. By then relating county-level measures of the number of TTAs signed to county-level measures of the number of bank failures, which we take as a proxy for local firms' financial distress, we establish a significant, positive relationship between financial distress and the number of firms signing TTAs with the Soviet Union.

Interpreted causally, our panel regression results relating firms' financial distress and TTA agreements help explain why U.S. firms signed these contracts in the first place. Despite the fact that these agreements were arguably critical to Soviet development (Sutton, 1968, 1971), promised Soviet payments were small and often unrealized (Link, 2020)

[1] These contracts generally involve a direct payment in return for some combination of an exchange of personnel for supervision and training purposes, help acquiring any necessary equipment or other inputs to production, and complete access to important "intangible assets" like patents and blueprints.

with no guarantees that the newly-established or improved Soviet plants and factories would not become competitors.[2] While historians have hypothesized that financial distress during the interwar period may have induced firms to sign TTAs with the Soviet Union (e.g., Hutchings, 1974), this explanation is complicated by the fact that many firms signed these contracts prior to the U.S. stock market crash in late 1929 and the banking panics of the Great Depression. By bringing new, cross-sectional panel data to this old question, we provide the first empirical test of this hypothesis and show that financial distress does indeed induce firms to sign such contracts. Across specifications estimated with all U.S. counties, we find that subjecting 1,000 U.S. counties to a one-standard deviation increase in our measure of firms' financial distress (bank failures) for one year results in between 6 and 13 additional TTAs signed nationwide in that year (for reference, our sample of TTAs includes 173 signed by the Soviet Union during the entire interwar period).

Important to our causal interpretation is the inclusion of both year and county fixed effects: year fixed effects capture aggregate shocks common to all counties occurring in both the United States and Soviet Union, such as the fact that the early years of the Great Depression (in which many banks failed) coincided with the first Soviet five-year plan (in which many TTAs were signed). County fixed effects capture important, time-invariant factors that we uncover which matter for determining which counties have firms with signed TTAs; specifically, we find that populous, literate counties with a high share of Russian nationals were more likely to have a TTA than others. We interpret this last fact as suggesting a role for cultural affinity in determining whether firms were likely to sign TTAs with the Soviet Union.

Finally, while the main focus of this paper is on showing that firms' financial distress, proxied by bank failures, induces them to sign TTAs, we also investigate whether this local financial distress is driven by a shock to the financial sector (a "credit supply" shock) or a local demand shock that causes banks to fail in response. In principle, if the

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

hypothesis regarding firms' financial distress and TTAs is correct, then the correlation between bank failures and TTAs that we uncover could either arise because an exogenous increase in bank failures worsens local credit conditions, or because a demand shock lowers firm revenues and also causes banks to fail. A large empirical literature is devoted to disentangling the causes and consequences of credit disruptions for local economic activity during the Great Depression, studying the effects on individuals and property values (e.g., Quincy, 2023), firms (e.g., Mitchener and Richardson, 2019; Hansen and Ziebarth, 2017; Nanda and Nicholas, 2014; Ziebarth, 2013; Richardson and Troost, 2009), and incomes (e.g., Calomiris and Mason, 2003a). In a supplementary appendix, we contribute to this literature by using the IV approach in Calomiris and Mason (2003a) to show that exogenous, negative shocks to credit supply raised the number of TTAs signed during the early years of the Great Depression.

Our results have important implications for policymakers in developing economies today. While existing empirical work demonstrates that technology transfer benefits *receiving* firms, no prior study quantitatively investigates the incentives of *sending* firms to help set up foreign competitors. In general, due to a paucity of data, empirical studies using direct measures of technology transfer are rare, as noted by Van Reenen and Yueh (2012) who establish that technology transfer agreements benefit receiving firms by using survey data to construct a panel of Chinese foreign joint ventures from 2000 to 2005 (which included 29 TTAs). Most other studies, like ours, take advantage of historical data: see Giorcelli (2019), who studies the impact of U.S. technology transfers to Italy as part of the Marshall Plan, and Giorcelli and Li (2023) for Soviet transfers to China during the 1950s. For the case of U.S. transfers to the Soviet Union, Sutton (1968, 1971) argues from qualitative evidence and correlations that the TTAs we study were critical to Soviet development in the 1920s and 1930s.[3] Thus, despite the desirability of such contracts, there is no formal, empirical guidance for policymakers in developing countries searching for partners in developed countries. We address this gap by providing a new historical dataset on interwar U.S. technology transfers to the Soviet Union, using it to show that

[3]See Cook (2012) for an analysis of Soviet innovation after World War II which highlights the productivity of domestic Soviet innovation.

economic incentives (financial distress), along with cultural affinity, appear to affect firms' willingness to transfer technology and do business with a foreign government—even across significant ideological divides.[4]

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 came to power in the "October Revolution," the United States broke off diplomatic relations with Russia. The U.S. would not formally recognize the Soviet Union diplomatically until November of 1933, when President 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 I, the Soviet leadership determined that foreign equipment and expertise were needed to stabilize a struggling postwar economy and 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 (Sutton, 1968). Once this tendency became apparent to foreign investors, 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. It is these "Technology Transfer Agreements" (TTAs) to which we restrict attention.

Technology transfer agreements were concluded by the Soviet government directly with firms, and they were signed primarily, though not exclusively, with firms in the United States.[5] The agreements overwhelmingly covered projects in manufacturing (over 75%), though some TTAs involved Soviet projects in the mining, utilities, construction

[4]The dataset is available on openICPSR (Jiang and Weber, 2024).

[5]German firms were also an important source of these agreements early on, though over the course of the 1920s the Soviet Union began to turn increasingly towards American firms (Sutton, 1968).

or agriculture sectors; see Appendix Figure 3 for details. TTAs typically involved an exchange of personnel (foremen and engineers to supervise and train Soviet workers, and training trips for Soviet engineers in the United States), help acquiring any necessary equipment or other inputs to production, and complete access to any and all patents, blueprints, and other proprietary "intangible assets." The Soviet Union paid directly for these services, which were arguably critical to its industrial development; see Sutton (1968) for a general overview of early Soviet attempts to acquire Western technology, and Link (2020) for a thorough discussion of the case of Ford Motor Company.

These TTAs did not entail the expropriation risk of earlier concession agreements, and there was also little to no legal or regulatory risk, as these contracts were not illegal or otherwise discouraged by U.S. government policy. Note that although World War I was widely understood by contemporaries to be a watershed moment demonstrating the importance of a technologically-advanced industrial sector for determining war potential, measures taken during World War I to prevent the transfer of technology abroad were allowed to lapse afterwards—in contrast to World War II, after which export controls designed to restrict the transfer of technology abroad became a fixture of U.S. foreign policy continuing into the present day (Daniels and Krige, 2022).

However, legality aside, risk remained even with these agreements. The Soviet Union could renege on promised payments, as Ford discovered in the 1930s (Link, 2020), and skilled personnel sent abroad were occasionally arrested.[6] Moreover, U.S. firms may have worried about negative press and public image at home, given the U.S. public's attitude toward the Soviet Union, manifested most clearly in the Red Scare of 1919-1920 and anti-communist congressional hearings (US House of Representatives, 71st Cong., 1930). Accordingly, the Soviet Union took considerable pains to burnish its image among U.S. industrialists, going so far as to criminalize any negative report regarding agreements with foreign firms in 1925 (Sutton, 1968), and published lists of U.S. firms who had entered into agreements in various promotional periodicals. So although many countries were

[6]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.

signing TTAs and attempting to adopt U.S. technology at this time, including Germany and Japan (Link, 2020), the Soviet Union presents a unique opportunity to study TTAs at scale due to its unique public image problem in the United States, as it is these promotional lists that allow us to create our dataset.

3 Constructing the TTA Dataset

We compile a list of all U.S. firms which signed TTAs by combining individual lists published by the Soviet Union to advertise its business with U.S. firms.[7] Our primary sources include publications of the *Economic Review of the Soviet Union* by the Amtorg Trading Corporation (1929, 1930); Bron (1930); the *Economic Handbook of the Soviet Union* published by the American-Russian Chamber of Commerce (1931); and the "Bogdanov Papers" provided by the Soviet Union and made public as part of proceedings from an anti-communist Congressional investigation (US House of Representatives, 71st Cong., 1930). We also use lists provided by Sutton (1968, 1971), which provides useful coverage of the 1930s and includes some additional TTAs that were not as widely publicized. These lists collectively name 173 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 provide the date each TTA was signed or any details on the firm besides the name. Online Appendix Table A1 provides the final list of all the firms, along with a brief description taken from the original list, when one is provided; the entry is left blank otherwise. We then individually research each agreement to augment this list with information on the city each firm is located in and the year the TTA was likely signed.

This is no small task. 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 (US House of Representatives, 71st Cong., 1930), and

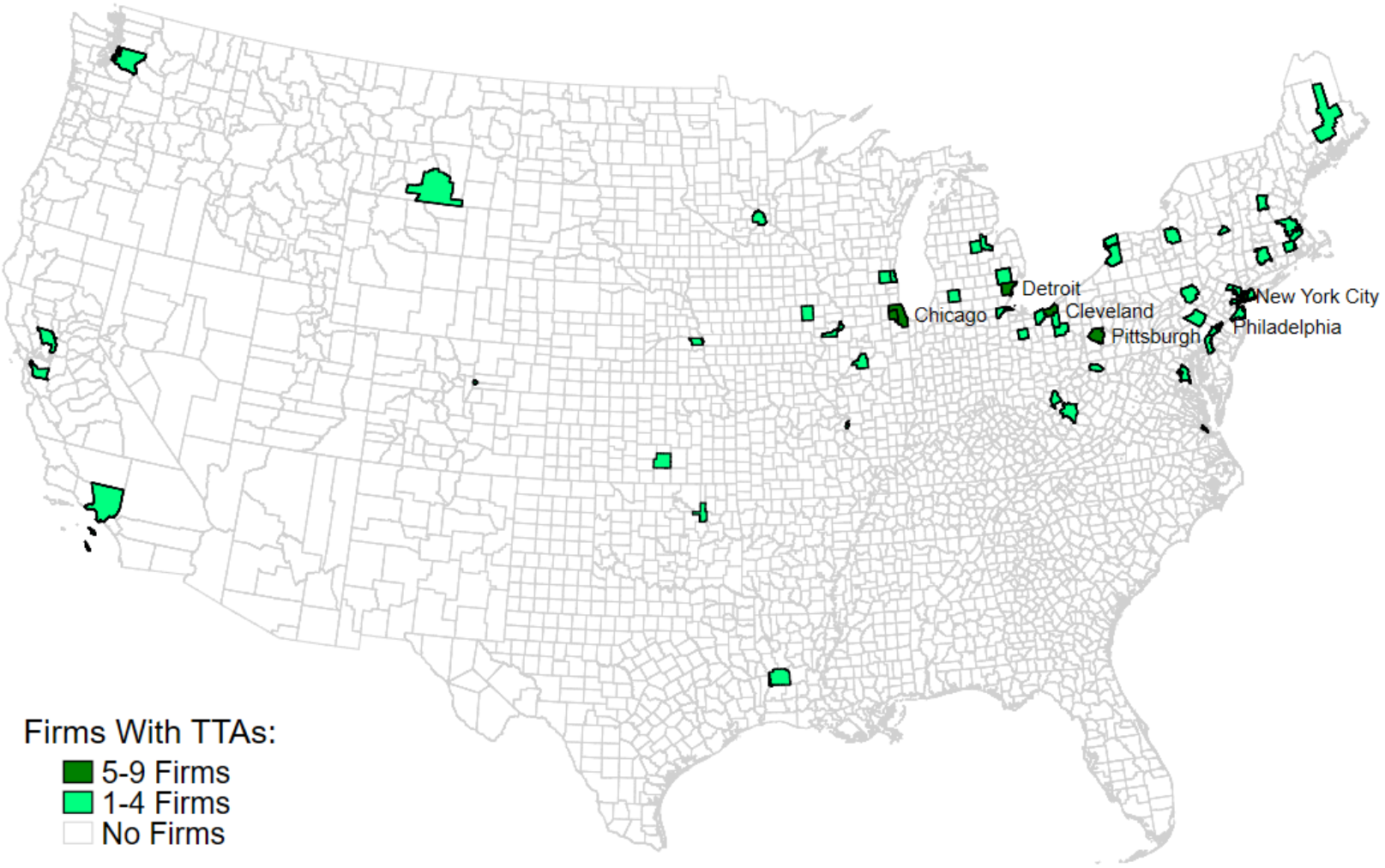
[7] While these published lists are not exhaustive in mentioning every agreement, in practice the Soviet Union publicized most agreements, though it often worked to hide subsequent negative news coverage as mentioned above (Sutton, 1968).

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 successfully locate 139 of the 173 firms that signed TTAs in 64 US counties, plotted in Figure 1. While Online Appendix Table A1 provides the source used to locate each TTA, in practice a small number of sources account for the majority of our locations:

- Location from the Bogdanov Papers (US House of Representatives, 71st Cong., 1930) or *Economic Handbook of the Soviet Union* (American-Russian Chamber of Commerce, 1931): 26%
- Location mentioned in a secondary source:
  - Sutton (1968, 1971): 15%
  - Ropes (1944): 7%
- Location taken from a patent: 14%
- Location taken from an object (trade catalogs) in the Smithsonian's online collection: 12%

This covers approximately 75% of our locations; for the remainder, we used a wide array of trade publications and news articles, often taking advantage of the journalistic convention of referring to individuals or firms as "ABC corp, of Chicago," to locate firms.

Figure 1: The Spatial Distribution of Interwar Technology Transfer Agreements



Notes: Spatial distribution of Technology Transfer Agreements (TTAs) signed with the Soviet Union in the interwar period. Note that the counties with the most TTAs (five or more, shaded dark green) are all associated with one of six cities: Chicago, Cleveland, Detroit, Philadelphia, Pittsburgh and New York City. One TTA in Alaska is not shown or included in the analysis.

In this particular example, note that it is not possible to locate the TTA in one county, because Chicago contains multiple counties, and so we equally divide the TTA agreement among them (so that it is possible for some counties to have only one half a TTA, in our sample, though in practice this is not common).

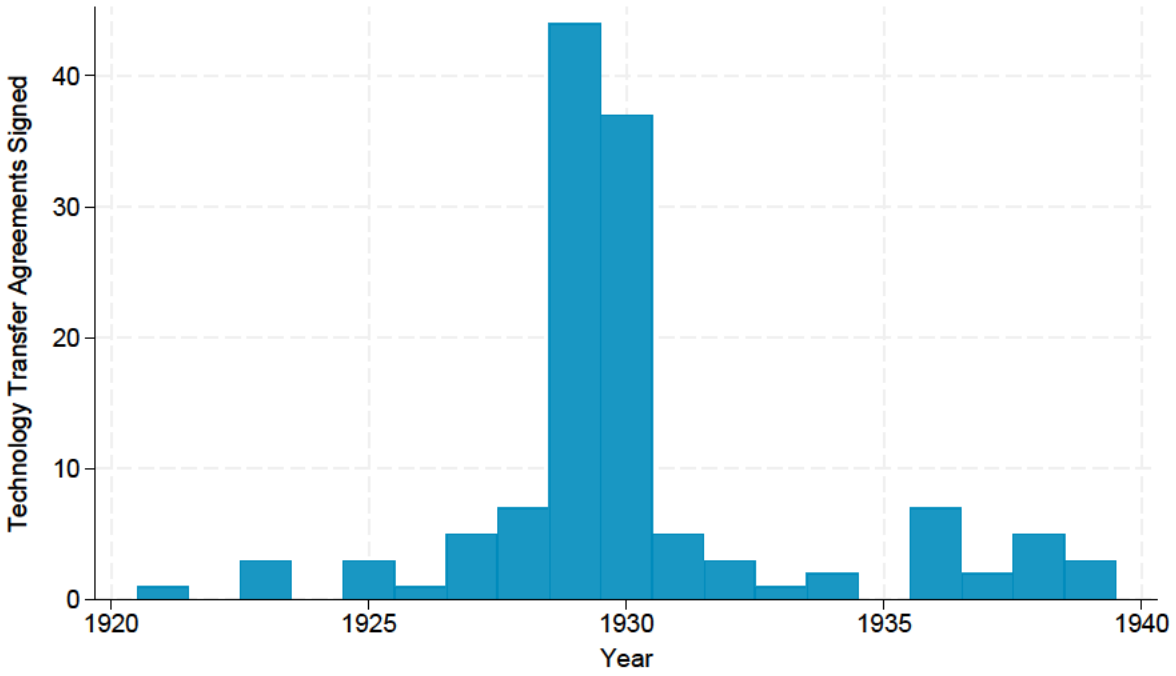
3.1 Building a County by Year Panel: Dating Each TTA

We also attempt to date each TTA. The Bogdanov Papers (US House of Representatives, 71st Cong., 1930) are extremely useful for this, providing the exact date (to the day) of many TTAs signed before the summer of 1930, which covers most of the five-year plan period in which a great many TTAs were signed. We do additional research, and are ultimately able to use Sutton's historical account (Sutton, 1968, 1971) or another source to provide dates for 131 TTAs (or 118, for which we have dates and locations). In all, just over 50% of these dates were obtained or inferred from Sutton's historical account and 41% from the Bogdanov Papers. Online Appendix Table A1 provides the source used for dating each TTA. A machine-readable version of this table and the data on TTAs used in this paper is available on openICPSR (Jiang and Weber, 2024).

We also bring in existing county-level data on bank failures using FDIC data on bank suspensions from ICPSR, following prior work which treats these bank failures as a measure of local financial distress (e.g., Nanda and Nicholas, 2014). Note that bank suspensions are not technically bank failures, as some banks that suspend operations may eventually reopen; however, Calomiris and Mason (2003b) argue that this distinction does not make a substantive difference when identifying bank distress empirically, and we abstract from it in discussion for simplicity. This and other demographic information from the 1930 U.S. Census were downloaded from IPUMS NHGIS (Manson et al., 2022).

As this FDIC data extends from 1920-1936, we limit our analysis of the effects of financial distress to these years (restricting to a narrower time frame, such as the period surrounding the first Soviet five year plan, does not qualitatively change the results; see Online Appendix B.1). However, most of the interwar TTAs were signed during this time, as shown in Figure 2. During this period of 1920 to 1936, we have 106 TTAs for

Figure 2: Technology Transfer Agreements Signed Over Time



Notes: Technology Transfer Agreements signed with the Soviet Union by U.S. Firms, over time. Plots 129 of the 131 agreements for which we determined the year signed (one in 1913 and one in 1944 are not shown) demonstrating that the majority were signed during the sample period of 1920 to 1936 for which we have county-level bank failure data, and in particular during the first Soviet five year plan, 1928-1932.

which we have both the location and the year. We also drop counties in Hawaii, Alaska, Wyoming, and Washington D.C. which are not covered by the FDIC dataset.

3.2 Limitations

There are several limitations with our dataset. The first is that we introduce noise whenever we make errors in assigning firms to locations or TTAs to years. In particular, with locations, we assume in what follows that firms do not change their location or the location of their headquarters: if we find a patent assigned to a firm located in Chicago in 1927, we assume that they remain located in Chicago for the entire interwar period absent evidence to the contrary. To the extent that this is not true, this will introduce noise into our measure of TTAs in each county and bias us away from finding any effect of financial distress on the number of TTAs signed in a county.

Relatedly, we may also have measurement error in the assignation of TTAs to dates. While the Bogdanov Papers provide precise dates, to the exact day, for many TTAs, we rely on the narrative record in Sutton (1968, 1971) or other secondary sources for dating the remainder of our TTAs. Even restricting to the level of year, it is sometimes not possible to precisely date a TTA, and any errors in judgement on our part could potentially introduce measurement error.

A final limitation worth noting is the small sample size: 106 TTAs provide the data underlying our headline panel regressions in Section 4 below. However, the fact that many counties did not have any of these agreements, despite having bank failures, is also data, and our headline regressions exploit these "zeros" which explains the large samples in our panel regression; restricting the analysis to only include counties which sign at least one TTA, and dropping these "zeros", does not qualitatively change the analysis, as we will discuss below.

4 Quantitatively Exploring Where TTAs Were Signed

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. To investigate the county-specific features that are associated with a propensity to sign any TTAs at all with the Soviet Union, we begin by estimating the following regression:

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

Equation (1) describes a linear probability model wherein the left hand side is a dummy variable taking on the value of 1 if County i has at least one TTA, where $X_{i,1930}$ is a vector of county-specific demographic variables computed from the 1930 census.[8] Table 1 displays the resulting estimates for β, demonstrating that populous, literate counties

[8]Note that this means, for this regression, we are able to use TTAs for which we have the location but not the year in Online Appendix Table A1.

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

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***
	(0.011)
Log Manufacturing Establishments	0.004
	(0.006)
Russian Share of Population	0.033*
	(0.015)
Urbanization Rate	-0.002
	(0.004)
Manufacturing Employment Share	0.012
	(0.008)
Literacy Rate	0.006**
	(0.002)
Observations	2470
R^2	0.189

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 U.S. 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 (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 3.3%). Standard errors in parentheses, clustered by U.S. State.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

For the period of $t \in [1920, 1936]$ for which we have FDIC bank failure data, we

estimate the following regression: for each county i,

$$\text{TTAs}_{i,t} = \gamma_i + \mu_t + \beta_0 \text{Bank Failures}_{i,t} + \epsilon_{i,t}, \tag{2}$$

where γ_i and μ_t are county and year fixed effects, respectively. In addition to county fixed effects, we include year fixed effects to capture aggregate shocks which would affect the number of TTAs signed in all counties. For example, the changes in Soviet policy discussed in Section 2 led to an increase in the total TTAs signed over time, as can be seen in Figure 2, while other aggregate shocks, such as the ongoing civil war and famine in the Soviet Union in 1921 and 1922, may have reduced the number of TTAs signed with all U.S. counties in the earliest years of the sample. Changes in policy and aggregate shocks like these explain the low number of TTAs seen in the early 1920s despite the fact that there were several significant local banking panics in the U.S. during this time (Jalil, 2015; Davison and Ramirez, 2014) and motivate the inclusion of year fixed effects in equation (2).

In Table 2, we show that estimates of β_0 are positive and significant, consistent with the idea that bank failures and the concomitant financial distress associated with them lead more firms to sign TTAs with the Soviet Union. By providing estimates with and without fixed effects, Table 2 demonstrates that adding county fixed effects reduces the point estimate of β_0, and that adding year fixed effects does not change much once county fixed effects are included. In interpreting these correlations as causal evidence on the effect of firms' financial distress on TTAs, we require that bank failures (and the financial distress associated with them) are orthogonal (i.e., as good as randomly assigned) with respect to all other unobserved factors that might be correlated with TTAs. Given the inclusion of year and county fixed effects, this assumption would be invalidated by the existence of some county-specific, time-varying shock that drives both TTAs and bank failures in the same direction and which does not operate through our proposed channel of firm financial distress. With this caveat in mind, we assume that no such shock exists and proceed to interpret the evidence here as causal.

We also consider several robustness checks. Table B1 estimates equation (2) dropping

Table 2: Local Financial Distress Induces U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union [1920-1936]

	(1) TTAs	(2) TTAs	(3) TTAs
Bank Failures	0.008**	0.006*	0.007*
	(0.003)	(0.002)	(0.003)
Observations	51833	51833	51833
R^2	0.023	0.149	0.153
County Fixed Effects		X	X
Year Fixed Effects			X

Notes: Standard errors in parentheses, clustered by U.S. State. The dependent variable is the total number of TTAs signed. This table estimates the total number of TTAs signed by U.S. Firms in county i at time t as a linear function of county-level bank failures measured as bank suspensions. All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

each of the six major cities labeled on Figure 1, to show that the results are not driven by one particular outlier with many TTAs and bank failures. Dropping Chicago has the largest effect on the point estimate, but the results remain positive and significant and well within the order of magnitude of the other estimates.

We also estimate equation (2) over the small subsample of counties which have at least one TTA, to highlight that the large number of "zeros" in the data is not responsible for the small standard errors and statistical significance in Table B2. Note that dropping the zeros raises the point estimates and the statistical significance, consistent with the idea that including the counties which never sign a TTA introduces considerable noise. Intuitively, presumably there are many counties which would never produce a TTA, no matter how many banks fail, because they have no technology the Soviet Union is interested in acquiring.

Additionally, although Figure 2 demonstrates that most of our TTAs come from the period of the first Soviet five year plan, we check whether the results are driven by the early TTAs which tend to be more agricultural in nature (recall the later TTAs, which are related to World War II, are not used in the panel regressions because the FDIC data on bank failures ends in 1936). Online Appendix B.1 estimates these panel regressions on a

subsample of the years 1926 to 1933 (inclusive) to show that the results are qualitatively unchanged.

Note that these results all take bank failures as a proxy for measuring firms' financial distress, which we show is correlated with the number of TTAs signed in a county. In principle, if the hypothesis that firms' financial distress induces them to sign TTAs is correct, then the correlation between bank failures and TTAs that we uncover could arise either because an exogenous increase in bank failures worsens local credit conditions, or because an adverse local demand shock lowers firm revenues and also causes banks to fail. Appendix C borrows the IV approach in Calomiris and Mason (2003a) to show that exogenous, negative shocks to credit supply raised the number of TTAs signed during the early years of the Great Depression. This suggests that local credit disruptions induce firms to sign TTAs, so that banking panics may thus create opportunities for foreign countries to acquire affected firms' technology.

Across these specifications, the R-squared values are small, but this is to be expected; beyond the fact that measurement error is biasing our coefficient estimates towards zero, as discussed above, the decision to work with the Soviet Union may have been highly idiosyncratic. It is thus not surprising that our results, with their low R-squared values, leave room for other explanations, especially given the results on Russian Share of the Population presented in Table 1 which suggest a role for cultural affinity and other non-economic factors. We conclude that financial distress played a role in inducing U.S. firms to sell technology to the Soviet Union, but that it was likely far from the only important factor.

5 Conclusion

This paper provides the first quantitative evidence that U.S. firms were induced to sell their 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 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.

Our results have important implications for policymakers in developing economies, which continue to make use of technology transfer agreements today. While there is abundant evidence on the benefits of technology transfer for receiving firms, there is little evidence on the motives of sending firms to sign TTAs. We fill this gap by providing the first quantitative, empirical guidance on where to look for private sector partners when importing technology from other countries.

The reason for this gap is broadly that direct measures of technology transfer are rare, as noted by Van Reenen and Yueh (2012). Accordingly, to establish these results, we have provided a novel dataset by compiling a list of all U.S. firms which signed TTAs. We accomplished this by combining individual lists published by the Soviet Union to promote its business with U.S. firms, and further individually researching each agreement to augment this list with information each firm's location and the year the TTA was likely signed. By making this dataset publicly available, we have modestly addressed this gap in measurement in the literature.

In particular, this dataset opens up various potential avenues for future work. At the local level, the data could be used to test other potential determinants of TTAs, and investigate whether, for example, the decline in TTAs that we observe after 1931 reflects the end of the first Soviet five year plan (1928 to 1932) or the stimulus associated with the New Deal (1933 to 1938), which may have alleviated firms' financial distress. At the individual level, linking the firms and individuals listed in Table A1 to U.S. census data could shed new light on the characteristics of the firms and individuals who signed these agreements, providing more insight into the mechanism. In short, we hope that the release of this dataset will encourage additional empirical work on the causes and consequences of technology transfer agreements.

References

American-Russian Chamber of Commerce, *Economic Handbook of the Soviet Union*, New York: American-Russian Chamber of Commerce, 1931.

Amtorg Trading Corporation, "Technical Assistance Contracts Concluded by Soviet Organizations With American Firms and Individuals," *Economic Review of the Soviet Union*, July 1st 1929.

_ , "American Technical Assistance Contracts," *Economic Review of the Soviet Union*, April 1st 1930.

Baldwin Locomotive Works, *The History of the Baldwin Locomotives Works, 1831 – 1923*, Philadelphia: The Bingham Company, 1923.

Bron, Saul G, "Soviet economic development and American business," 1930.

Calomiris, Charles W and Joseph R Mason, "Consequences of bank distress during the Great Depression," *American Economic Review*, 2003, *93* (3), 937–947.

_ **and** _ , "Fundamentals, panics, and bank distress during the depression," *American Economic Review*, 2003, *93* (5), 1615–1647.

Cao, Wenxuan and Gary Richardson, "All Bank Statistics, United States, 1896-1955 (Digitized)," https://doi.org/10.3886/E182671V1 2022.

Case Western Reserve University, "CLETRAC,INC," https://case.edu/ech/articles/c/cletrac-inc. Accessed: 2023-05-22.

_ , "GLENN L. MARTIN CO.," https://case.edu/ech/articles/g/glenn-l-martin-co. Accessed: 2023-05-22.

Clark, Wallace, *The Gantt Chart: A Working Tool of Management*, New York: Ronald Press Company, 1922.

Cook, Lisa, "A Green Light for Red Patents? Evidence from Soviet Experiments with the Market and Innovation, 1959 to 1991," Technical Report 2012.

Curtiss-Wright, "HISTORY," https://www.curtisswright.com/company/history/. Accessed: 2023-05-22.

Dalrymple, Dana G., "The American Tractor Comes to Soviet Agriculture: The Transfer of a Technology," *Technology and Culture*, 1964, *5* (2), 191–214.

Daniels, Mario and John Krige, *Knowledge regulation and national security in postwar America*, University of Chicago Press, 2022.

Davison, Lee K and Carlos D Ramirez, "Local banking panics of the 1920s: Identification and determinants," *Journal of Monetary Economics*, 2014, *66*, 164–177.

Engineers' Club of St. Louis, *Yearbook of the Associated Engineering Societies of St. Louis* 1947.

Fay, Albert H., *A Glossary of the Mining and Mineral Industry*, Washington: Bureau of Mines, 1920.

Giorcelli, Michela, "The long-term effects of management and technology transfers," *American Economic Review*, 2019, *109* (1), 121–52.

_ **and Bo Li**, "Technology transfer and early industrial development: Evidence from the Sino-Soviet alliance," Technical Report 2023.

Hansen, Mary Eschelbach and Nicolas L Ziebarth, "Credit relationships and business bankruptcy during the Great Depression," *American Economic Journal: Macroeconomics*, 2017, *9* (2), 228–255.

Hines, J.S., "AXELSON LATHES ON SHIPBOARD," *Pacific Marine Review*, 1919, *16.*

Hutchings, Raymond, *International Affairs (Royal Institute of International Affairs 1944-)*, 1974, *50* (4), 651–654.

Jalil, Andrew J, "A new history of banking panics in the United States, 1825–1929: construction and implications," *American Economic Journal: Macroeconomics*, 2015, *7* (3), 295–330.

Jiang, Jerry and Jacob Weber, "Interwar Technology Transfer Agreements Between U.S. Firms and the Soviet Union: 1920-1940," https://doi.org/10.3886/E210261V1 November 5th 2024. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor].

John Deere & Co., "John Deere," https://www.deere.com/en/our-company/history/john-deere/. Accessed: 2023-05-22.

Leffingwell, Randy, *Classic farm tractors: history of the farm tractor*, Osceola, WI: MBI Publishing Company, 1996.

Levinson, Joel B., "Union Switch & Signal," https://digital.library.pitt.edu/islandora/object/pitt:201501.01.004.8 1996. Accessed: 2023-12-20.

Library of Congress, "Sullivan Machinery Company, Main Street between Pearl & Water Streets, Claremont, Sullivan County, NH," https://www.loc.gov/item/nh0127/. Accessed: 2023-12-20.

Lincoln, Samuel B., *Lockwood Greene: The History of an Engineering Business, 1832-1958*, Brattleboro: The Stephen Greene Press, 1960.

Link, Stefan J, *Forging Global Fordism: Nazi Germany, Soviet Russia, and the contest over the industrial order*, Vol. 33, Princeton University Press, 2020.

Manson, Steven, Jonathan Schroeder, David Van Riper, Tracy Kugler, and Steven Ruggles, "IPUMS National Historical Geographic Information System: Version 17.0," http://doi.org/10.18128/D050.V17.0 2022.

MIT Museum, "Edward Furber Miller (1866-1933)," http://rklab.mit.edu/miller.html 1933. Anonymous author, written in 1933. Accessed: 2023-8-21.

Mitchener, Kris James and Gary Richardson, "Network contagion and interbank amplification during the Great Depression," *Journal of Political Economy*, 2019, *127* (2), 465–507.

Naleszkiewicz, Wladimir, "Technical Assistance of the American Enterprises to the Growth of the Soviet Union, 1929-1933," *The Russian Review*, 1966, *25* (1), 54–76.

Nanda, Ramana and Tom Nicholas, "Did bank distress stifle innovation during the great depression?," *Journal of Financial Economics*, 2014, *114* (2), 273–292.

National Museum of American History, "Trade catalogs from Allis-Chalmers Mfg. Co.," https://americanhistory.si.edu/collections/SILNMAHTL_19604. Accessed: 2023-03-21.

_ , "Trade catalogs from Ansonia Clock Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_36665. Accessed: 2023-03-21.

_ , "Trade catalogs from Boeing Aircraft Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_8248. Accessed: 2023-03-21.

_ , "Trade catalogs from Brown Instrument Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_8539. Accessed: 2023-03-21.

_ , "Trade catalogs from Bucyrus-Erie Co.," https://americanhistory.si.edu/collections/SILNMAHTL_8927. Accessed: 2023-03-21.

_ , "Trade catalogs from E. W. Bliss Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_8039. Accessed: 2023-03-21.

__ , "Trade catalogs from Foster-Wheeler Corp.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_15804. Accessed: 2023-05-22.

__ , "Trade catalogs from International Harvester Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_16602. Accessed: 2023-05-22.

__ , "Trade catalogs from Ohio Locomotive Crane Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_28935. Accessed: 2023-8-21.

__ , "Trade catalogs from Otis Elevator Co.," https://americanhistory.si.edu/collections/search/object/SILNMAHTL_31088. Accessed: 2023-8-21.

__ , "Trade catalogs from Pratt & Whitney Co.," https://americanhistory.si.edu/collections/SILNMAHTL_26313. Accessed: 2023-12-20.

__ , "Trade catalogs from Standard Oil Co. of New York," https://americanhistory.si.edu/collections/SILNMAHTL_34756. Accessed: 2023-12-20.

__ , "Trade Catalogs from Underwood Typewriter Co. Inc.," https://americanhistory.si.edu/collections/SILNMAHTL_25530. Accessed: 2023-12-20.

__ , "Trade Catalogs from Westinghouse Machine Co.," https://americanhistory.si.edu/collections/SILNMAHTL_25051. Accessed: 2023-12-20.

__ , "Trade catalogs from W.S. Rockwell Co.," https://americanhistory.si.edu/collections/SILNMAHTL_13466. Accessed: 2023-12-20.

Office of the Minnesota Secretary of State, "Business Record Details for Burd Piston Ring Company," https://mblsportal.sos.state.mn.us/Business/SearchDetails?filingGuid=cf46ab46-b2d4-e011-a886-001ec94ffe7f 1915.

Online Archive of California, "E. J. (Edward James) Stirniman Papers," https://oac.cdlib.org/findaid/ark:/13030/c8kw5j8v/entire_text/ 2015. Accessed: 2023-12-20.

PBS, "Leon Moisseif," https://www.pbs.org/wgbh/americanexperience/features/goldengate-moisseiff/. Accessed: 2023-8-21.

Quincy, Sarah, "Loans for the "Little Fellow:" Credit, Crisis, and Recovery in the Great Depression," Technical Report, National Bureau of Economic Research 2023.

Richardson, Gary and William Troost, "Monetary intervention mitigated banking panics during the great depression: quasi-experimental evidence from a federal reserve district border, 1929–1933," *Journal of Political Economy*, 2009, *117* (6), 1031–1073.

Ropes, Ernest C., "The Shape of United States-Soviet Trade, Past and Future," *Slavonic and East European Review. American Series*, 1944, *3* (2), 1–15.

Santalov, A. A. and Louis Segal, *Soviet Union year-book 1929*, London: George Allen & Unwin, 1929.
Shapiro v. Midwest Rubber Reclaiming Co.

***Shapiro v. Midwest Rubber Reclaiming Co.**, 1980. 626 F.2d 63 (8th Cir. 1980). Accessed: 2024-01-17.*

Stone, Charles H., *The History of Marietta Manufacturing Company, Huntington, West Virginia: The John Deaver Drinko Academy for American Institutions and Civic Culture, Marshall University, 2006.*

Surface, Karalee, *"Chain Belt Company," https://emke.uwm.edu/entry/chain-belt-company/ 2016. Accessed: 2023-05-22.*

Sutton, Antony C., *Western Technology and Soviet Economic Development 1917 to 1930, Stanford, CA: Hoover Institution Press, 1968.*

__ , *Western Technology and Soviet Economic Development 1930 to 1945, Stanford, CA: Hoover Institution Press, 1971.*

Syracuse University, *"Ralph E. Flanders Papers An inventory of his papers at Syracuse University,"* https://library.syracuse.edu/digital/guides/print/flanders_re_prt.htm *2016. Accessed: 2023-12-20.*

__ , *"American Locomotive Company (ALCO) Records,"* https://library.syracuse.edu/digital/guides/a/alco.htm *2022. Accessed: 2023-03-20.*

The Historical Society of Pennsylvania, *"Forges and Furnaces collection 1727 – 1921,"* https://hsp.org/sites/default/files/legacy_files/migrated/findingaid212forgesandfurnaces.pdf *Philadelphia, PA 2005. Accessed: 2024-01-17.*

The New York Times, *"PAID $147,370 GRAFT TO UNION IN CHICAGO," The New York Times, May 15th 1921.*

TIME, *"Business: Steel Deal,"* https://content.time.com/time/subscriber/article/0,33009,741089-1,00.html *1931. Accessed: 2024-01-17.*

United States Arms Control and Disarmament Agency, *The post layoff market experiences of the former republic aviation corporation (long island) workers, Washington: United States Arms Control and Disarmament Agency, 1966.*

US Department of State, *"Economic Matters: Five-Year Plans, Living Conditions, Internal And International Socialist Living Affairs, Insurance," Technical Report 75382861, National Archives and Record Services, Washington 1980.*

US House of Representatives, 71st Cong., *Investigation of Communist Propaganda number pt. 1, v. 1-5. In 'Investigation of Communist Propaganda: Hearings Before a Special Committee to Investigate Communist Activities in the United States of the House of Representatives, Seventy-first Congress, Second Session, Pursuant to H. Res. 220, Providing for an Investigation of Communist Propaganda in the United States.', U.S. Government Printing Office, 1930.*

Van Reenen, John and Linda Yueh, *"Why has China grown so fast? The role of international technology transfer.," Centre for Economic Performance Discussion Paper, 2012.*

Vartabedian, Ralph, *"Textron Makes Offer to Acquire Ex-Cell-O: Hints It May Raise Its $966-Million Bid," LA times, 1986.*

Ziebarth, Nicolas L, *"Identifying the effects of bank failures from a natural experiment in Mississippi during the Great Depression," American Economic Journal: Macroeconomics, 2013, 5 (1), 81–101.*

Online-Only Appendices

A Dating and Locating TTA Agreements

Online Appendix Table A1 provides an alphabetical list of all U.S. firms which signed TTAs. It combines individual lists published by the Soviet Union to advertise its business with U.S. firms. Our primary sources include the *Economic Review of the Soviet Union* published by the Amtorg Trading Corporation (1929, 1930); Bron (1930); the *Economic Handbook of the Soviet Union* published by the American-Russian Chamber of Commerce (1931); and the "Bogdanov Papers" provided by the Soviet Union and made public as part of proceedings from an anti-communist Congressional investigation (US House of Representatives, 71st Cong., 1930). We also use lists provided by Sutton (1968, 1971), which provides useful coverage of the 1930s and includes some additional TTAs that were not as widely publicized (Sutton had access to archival evidence which we do not have).

These lists collectively name 173 firms and usually describe the technology being transferred. We present the names and descriptions verbatim, using brackets ("[]") to denote when we have inferred text which was illegible in a particular scan. If descriptions of the technology transferred have slightly different wording in two different lists, we provide the earlier description, though this rarely happens. "TTA Description" is left empty if a particular TTA appears only in lists which do not provide a description.

To determine locations for all firms, we use industry or trade publications, patent records, the Bogdanov Papers (US House of Representatives, 71st Cong., 1930), and other sources. 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 successfully locate 139 of the 173 firms that signed TTAs in cities spread across 64 US counties, plotted in Figure 1. The following sources account for the majority (about 75%) of our locations, with the precise share of the 139 firms given in each case:

- Location from the Bogdanov Papers (US House of Representatives, 71st Cong., 1930) or *Economic Handbook of the Soviet Union* (American-Russian Chamber of Commerce, 1931): 26%
- Location mentioned in a secondary source:
  - Sutton (1968, 1971): 15%
  - Ropes (1944): 7%
- Location taken from a patent: 14%
- Location taken from an object (trade catalogs) in the Smithsonian's online collection: 12%

For the remaining 25% of TTAs, we used a wide array of trade publications and news articles, often taking advantage of the journalistic convention of referring to individuals or firms as "ABC corp, of Chicago," to locate firms. Online Appendix Table A1 below gives the exact source used for each TTA's location.

We also attempt to determine the year each firm first signed a TTA. The Bogdanov Papers are extremely useful for this, providing the exact date (to the day) of many TTAs signed before the summer of 1930, which covers most of the Soviet first five-year Plan

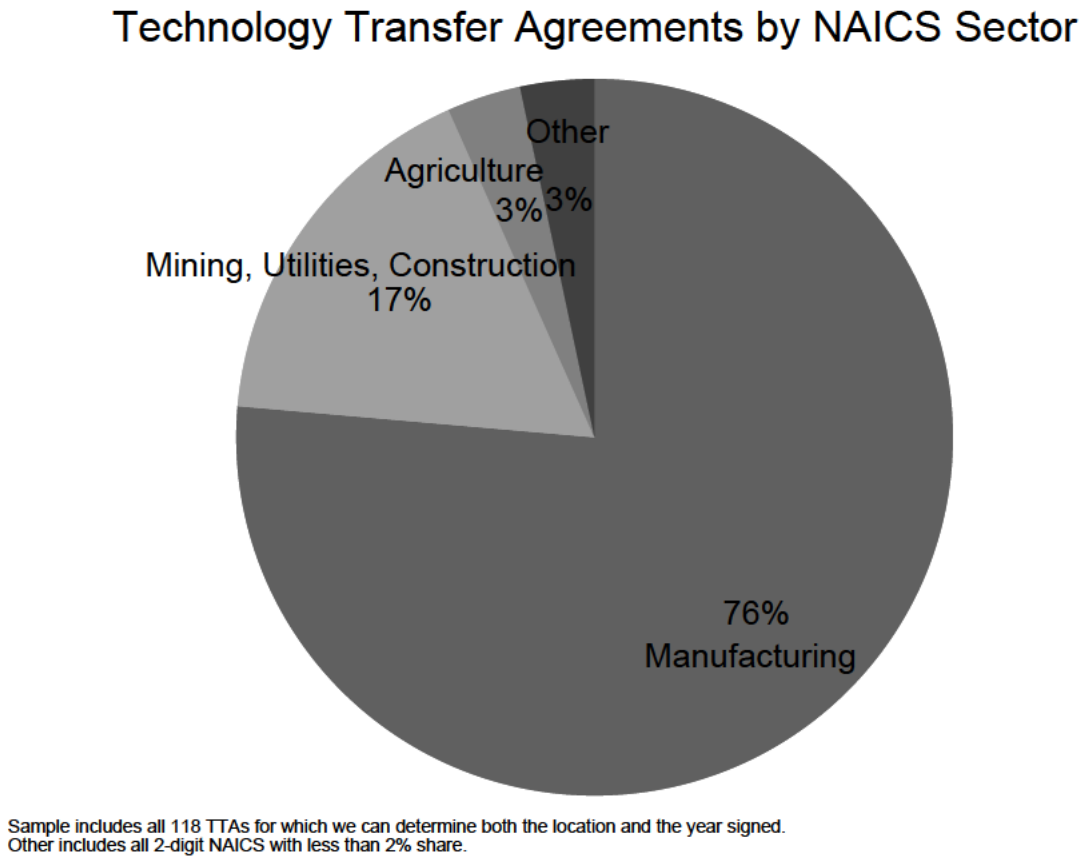


Figure 3: The distribution of TTA agreements by industry.

period in which a great many TTAs were signed. We do additional research, and are ultimately able to use Sutton's historical account (Sutton, 1968, 1971) or another source to provide dates for 131 TTAs (or 118, for which we have dates and locations). In all, just over 50% of these dates were obtained or inferred from Sutton's historical account and 41% from the Bogdanov Papers. Online Appendix Table A1 below gives the exact source used for each TTA's date.

The final dataset provides NAICS codes for selected TTAs, including all 118 for which we determined both the location and the date. The industry is determined by the project or firm being developed by the Soviet Union. The broad results are displayed in Figure 3

Table A1: Dating and Locating US-USSR Technology Transfer Agreements

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
1	Accounting and Tabulating Machine Co.	Power Machines	1930	Kingston, Pennysylvania	Sutton (1971)	US House of Representatives, 71st Cong. (1930)
2	Akron Rubber Reclaiming Company	Technical Assistance to the Soviet Rubber Trust in the construction of a reclamation plant	1929	Baberton, Ohio	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
3	Alco Products, Inc.	Petroleum Refineries	1933	Schenectady, New York	Sutton (1971)	Syracuse University (2022)
4	Allen and Garcia Company	Technical Asssistance in the designing and opening of new coal mines for the Donugol Coal Trust.	1927	Chicago, Illinois	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
5	Allen, J.I., and Co.					
6	Allis-Chalmers Manufacturing Co.		1923	Milwaukee, Wisconsin	Sutton (1968)	National Museum of American History (n.d.a)
7	American Can Co.	Canning Processes				
8	Robert J. Anderson	Consulting engineer in aluminum-producing plant	1928	Fairmont, West Virginia	US House of Representatives, 71st Cong. (1930)	Patents
9	Ansonia Clock Co.	Clocks and Watches	1929	Brooklyn, New York	US Department of State (1980)	National Museum of American History (n.d.b)
10	Audio-Cinema Inc	Sound film technology				
11	Austin Company	Technical Assistance in the desgning and opening of new coal mines for the Donugol Coal Trust	1929	Cleveland, Ohio	Sutton (1968)	US House of Representatives, 71st Cong. (1930)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
12	Arthur J. Brandt	Reconstruction of the Amo (Moscow) automobile plant for the Avtotrest (Auto Trust)	1930	Dearborn, Michigan	US House of Representatives, 71st Cong. (1930)	US House of Representatives, 71st Cong. (1930)
13	Babcock & Wilcox, Inc.	Newsprint Manufacture				
14	Badger, E. B., & Sons	Wood distillation, oil refineries	1929	Boston, Massachusetts	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
15	Badger & Sewell Co.	Newsprint Manufacture				
16	Baldwin Locomotive Works	Locomotive repair shops	1929	Eddystone, Pennsylvania	US House of Representatives, 71st Cong. (1930)	Baldwin Locomotive Works (1923)
17	Baltimore & Ohio Railroad	Railroad operations				
18	Birdsboro Steel Foundry & Machine Co,	Hydraulic presses	1938	Birdsboro, Pennysylvania	Sutton (1971)	The Historical Society of Pennsylvania (2005)
19	Bliss, E. W., Co.	Powert-plant design	1938	Brooklyn, New York	Sutton (1971)	National Museum of American History (n.d.f)
20	Blom and Kamroth	Meat-packing plants				
21	Boeing Aircraft Co.	Aircraft	1939	Seattle, Washington	Sutton (1971)	National Museum of American History (n.d.c)
22	Brown Instrument Co.	Electrical recording Instrument	1936	Philadelphia, Pennysylvania	Sutton (1971)	National Museum of American History (n.d.d)
23	Brown Lipe Gear Company	Technical Assistance to Avtotrest	1930	Syracuse, New York	Sutton (1968)	American-Russian Chamber of Commerce (1931)
24	Bucyrus-Erie Co	Excavating equipment	1923	Milwaukee, Wisconsin	Sutton (1968)	National Museum of American History (n.d.e)
25	Budd Manufacturing Co	1934 auto model change	1936	Philadelphia, Pennysylvania	Sutton (1971)	Sutton (1971)
26	Burd Piston Ring Co	Tractors	1930	Minneapolis, Minnesota	Sutton (1971)	Office of the Minnesota Secretary of State (1915)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
27	Burrell-Mase Engineering Company	Rationalization and Expansion of gas and gasoline industry for Grozneft		Pittsburgh, Pennsylvania		American-Russian Chamber of Commerce (1931)
28	J. K. Calder	Chief Superintendent of construction of tractor plants	1929	Detroit, Michigan	US House of Representatives, 71st Cong. (1930)	Dalrymple (1964)
29	Campbell, Thomas		1929	Crow Agency, Montana	Dalrymple (1964)	Dalrymple (1964)
30	Caterpillar Tractor Co.	Training Soviet Nationals	1929	East Peoria, Illinois	Sutton (1968)	Leffingwell (1996)
31	Chain Belt Co.	Conveyors	1930	Milwaukee, Wisconsin	Sutton (1971)	Surface (2016)
32	Chase, Frank D., Inc.	Design of foundry projects	1929	Chicago, Illinois	US House of Representatives, 71st Cong. (1930)	
33	Chicago Kitchen Co.	Design of community kitchens				
34	Clark, Wallace, & Co.	Gantt methods	1934	New York, New York	Sutton (1971)	Clark (1922)
35	Cleveland Tractor Co.	Training Soviet Nationals	1929	Cleveland, Ohio	Dalrymple (1964)	Case Western Reserve University (n.d.a)
36	Hugh Lincoln Cooper	Consulting engineers on the construction of the Dnieper River hydro-electic power plant in Ukraine	1927	New York, New York	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
37	Curtiss-Wright Corp.	Aircraft engine manufacturing license	1934	Buffalo, New York	Sutton (1971)	Curtiss-Wright (n.d.)
38	Arthur P. Davis, Lyman Bishop	Consulting engineers on the irrigation projects of the "Sredazvodkhoz"	1913	Oakland, California	Sutton (1971)	American-Russian Chamber of Commerce (1931)
39	Deere & Co.	Agricultural equipment	1930	Moline, Illinois	Sutton (1971)	John Deere & Co. (n.d.)
40	Dewey & Almy Chemical Co.	Crab meat containers	1938	Cambridge, Massachusetts	Sutton (1971)	Sutton (1971)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
41	Frank E. Dickie	Technical Assistance for Aluminstroy		Detroit, Michigan		American-Russian Chamber of Commerce (1931)
42	Diebold Safe & Lock Co.	Watch factory		Canton, Ohio		
43	Douglas Aircraft Co., Inc.	Aircraft: DC-3	1936	Santa Monica, California	Sutton (1971)	
44	Dow Chemical Co.	Styrene	1939	Midland, Michigan	Sutton (1971)	
45	Dueber-Hampden Watch Co.	Construction and equipment of watch plant	1929	Canton, Ohio	US Department of State (1980)	
46	DuPont de Nemours and Company	Technical Assistance in erecting fertilizer factories	1929	Wilmington, Delaware	US House of Representatives, 71st Cong. (1930)	
47	Eastman Construction Engineering	Construction		Philadelphia, Pennsylvania		American-Russian Chamber of Commerce (1931)
48	Electric Auto-Lite Co.	Electrical equipment in autos and tractors	1930	Toledo, Ohio	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
49	Ex-Cell-O Aircraft and Tool Corp.	Stated by Soviets as agricultural implements	1931	Highland Park, Michigan	Sutton (1971)	Vartabedian (1986)
50	Fairbank Aviation Corp.	Aircraft manufacture				
51	Farrel-Birmingham Co., Inc.	Sykes machines	1936	Buffalo, New York	Sutton (1971)	Sutton (1971)
52	Albert H. Fay	Consulting Mining Engineer	1929	Washington, D.C.,	US House of Representatives, 71st Cong. (1930)	Fay (1920)
53	Hardy S. Ferguson and Company	Technical Assistance to Severoles		Millinocket, Maine		Patents

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
54	Ford Motor Company	Technical Assistance in the operation of the Nizhni Novgorod automobile factory	1929	Dearborn, Michigan	US House of Representatives, 71st Cong. (1930)	US House of Representatives, 71st Cong. (1930)
55	Foster-Wheeler Corp	Petroleum refineries		New York, New York		National Museum of American History (n.d.g)
56	Freyn Engineering Company	Consulting engineers for the Gipromez	1928	Chicago, Illinois	Sutton (1968)	American-Russian Chamber of Commerce (1931)
57	General Engineering Co., Inc			Denver, Colorado		Sutton (1968)
58	Harry D. Gibbs	Technical Assistance in the construction of the Soviet aniline industry	1929	Hyattsville, Maryland	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
59	Julius H. Gillis	construction engineer	1930	Elizabeth, New Jersey	US House of Representatives, 71st Cong. (1930)	Patents
60	Gogan Machine Co.	Automobile Bumper	1932	Cleveland, Ohio	Sutton (1971)	Sutton (1971)
61	Goodman manufacturing company	Factory to produce coal cutters	1929	Chicago, Illinois	US House of Representatives, 71st Cong. (1930)	Sutton (1968)
62	Graver Corp.	Refineries	1928	Chicago, Illinois	Sutton (1968)	Sutton (1968)
63	Hahn, A. W.	Aluminium Powder	1930	Bronx, New York	US House of Representatives, 71st Cong. (1930)	Patents
64	T. G. Hawkins, Jr.			New York, New York		American-Russian Chamber of Commerce (1931)
65	H. Henrichsen	Construction of tractors	1930		US House of Representatives, 71st Cong. (1930)	
66	Henshien and Co., Inc.	Meat Packing Plants	1930	Chicago, Illinois	Sutton (1968)	Sutton (1968)
67	Hercules Motor Company	Production of engines for trucks in the Amo automobile plant of the Avtotrest	1929	Canton, Ohio	Sutton (1971)	Sutton (1971)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
68	Hercules Powder Co.	Nitroceullulose; cotton linters		Wilmington, Delaware		Sutton (1971)
69	Houdry Process Corp.	Catalysts				
70	William M. Hibbs	Construction engineer of mechanical plants	1930		US House of Representatives, 71st Cong. (1930)	
71	John J. Higgins	G.E.T (State Electrotechnical Trust)	1929	East Orange, New Jersey	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
72	International General Electric Company	Exchange of patients with the state Electro-technical trust	1929	New York, New York	US House of Representatives, 71st Cong. (1930)	US House of Representatives, 71st Cong. (1930)
73	International Harvester Co.	Training Soviet Nationals	1930	Chicago, Illinois	Sutton (1971)	National Museum of American History (n.d.h)
74	Irving Airchute	Assistance in aviation industry	1930	Buffalo, New York	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
75	Jenkins Co.	Petroleum refineries				
76	Albert Kahn Inc	Design of buildings for the Stalingrad tractor factory	1929	Detroit, Michigan	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
77	Kallitt Products, Inc.	Electrical equipment				
78	Charles F. Kamrath	Meat-packing plants	1929	Omaha, Nebraska	US House of Representatives, 71st Cong. (1930)	Patents
79	Koppers Construction Co.	Coke ovens and by-products	1930	Pittsburgh, Pennsylvania	Sutton (1971)	Sutton (1971)
80	M. W. Krejci	[non-ferrous] metal industry	1930		US House of Representatives, 71st Cong. (1930)	
81	Lockwood Greene and Company	Reorganization and reconstruction of the of existing textile mills and in the design and construction of new plants.	1929	New York, New York	Sutton (1968)	Lincoln (1960)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
82	Longacre Engineering and Construction Company	Apartment Buildings	1929	New York, New York	US House of Representatives, 71st Cong. (1930)	The New York Times (1921)
83	Lucas & Luick	Gas plants and pipelines		Chicago, Illinois		American-Russian Chamber of Commerce (1931)
84	Lummus Co.	Refinery Construction	1936	New York, New York	Sutton (1971)	Sutton (1971)
85	Manganexport	Manganese Ore	1928		US House of Representatives, 71st Cong. (1930)	
86	Marietta Manufacturing Co.	Carbon-black paint units	1930	Point Pleasant, West Virginia	Sutton (1971)	Stone (2006)
87	F. W. Marlow	construction of meat-packing plant	1929	St. Louis, Missouri	US House of Representatives, 71st Cong. (1930)	Engineers' Club of St. Louis (1947)
88	Martin, Glenn L., Co.	Bomber design	1937	Cleveland, Ohio	Sutton (1971)	Case Western Reserve University (n.d.b)
89	McClintock & Marshall Const. Co.	Building erection for Stalingrad tractor Plant	1930	Pittsburgh, Pennsylvania	Sutton (1971)	TIME (1931)
90	McCormick Company	Designing of Baking Plants	1929	Pittsburgh, Pennsylvania	Sutton (1968)	Sutton (1968)
91	J. K. McElroy	Cheliabinsk Tractor plant	1930	Detroit, Michigan	US House of Representatives, 71st Cong. (1930)	Dalrymple (1964)
92	Arthur G. McKee & Co.	Assistance on the project to develop Magnitogorsk as a steel center	1930	Cleveland, Ohio	US House of Representatives, 71st Cong. (1930)	US House of Representatives, 71st Cong. (1930)
93	McDonald Engineering	Construction of industrial plants	1929	Chicago, Illinois	Sutton (1968)	Ropes (1944)
94	Mechanical Manufacuring Company	meat-packing industry	1930	Chicago, Illinois	Sutton (1968)	Ropes (1944)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
95	Merritt Engineering & Sales Co., Inc.	Manufacture of rolled-steel railroad-car wheels	1928	Lockport, New York	US House of Representatives, 71st Cong. (1930)	Patents
96	Midwest Rubber Reclaiming Co.	Assistance in rubber-plant construction: Training Soviet Nationals		St. Louis, Missouri		*Shapiro v. Midwest Rubber Reclaiming Co.* (1980)
97	E. F. Miller	Donugol in the coal industry	1926	Boston, Massachusetts	US House of Representatives, 71st Cong. (1930)	MIT Museum (1933)
98	J. K. Miller	Manufacture of [watches]	1929		US House of Representatives, 71st Cong. (1930)	
99	Miller, Max B., and Co.	Petroleum refineries				
100	Moisseiff, Leon S.	Bridge Construction	1929	Belmar, New Jersey	Sutton (1971)	PBS (n.d.)
101	B. W. Mullen	Construction of [blast] furnaces	1930		US House of Representatives, 71st Cong. (1930)	
102	Multibestos Co.	Creating an asbestos plant in Yaroslavl	1929	Walpole, Massachusetts	US House of Representatives, 71st Cong. (1930)	Sutton (1971)
103	National Rubber Machinery Co.	Tire-building Machines	1944	Akron, Ohio	Sutton (1971)	
104	Newport News Shipbuilding & Drydock Co.	Construction of turbines	1927	Newport News, Virginia	Sutton (1968)	Ropes (1944)
105	Nickel, Arthur Co.	Iron-ore mining	1930	Waukensha, Wisconsin	Sutton (1971)	
106	Nitrogen Engineering Co.	Construction and operating a large ammonia fertilizer factory	1921	New York, New York	Sutton (1968)	American-Russian Chamber of Commerce (1931)
107	Nordberg Manufacturing Co.	Railroad equipment		Milwaukee, Wisconsin		
108	Oglebay Norton Company	Yurt (Southern Ore Trust)	1929	Cleveland, Ohio	US House of Representatives, 71st Cong. (1930)	Ropes (1944)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
109	Ohio Locomotive Crane Co.	Operation and servicing of cranes	1931	Bucyrus, Ohio	Sutton (1971)	National Museum of American History (n.d.i)
110	C. R. Olberg	Engineer for irrigation	1929		US House of Representatives, 71st Cong. (1930)	
111	Oliver Farm Equipment Co.	Tractor Plows				
112	Orgametall	Manufacture of rolled-steel railroad-car wheels	1930		US House of Representatives, 71st Cong. (1930)	
113	Otis Elevator Co.	Moscow Subway Elevators		New York, New York	Sutton (1971)	National Museum of American History (n.d.j)
114	Owens Bottle Co.	Bottle-closing plant and machinery for silicate industries	1925	Toledo, Ohio	US House of Representatives, 71st Cong. (1930)	Patents
115	Parke, Davis & Co.	Pharmaceutical Products	1929	Detroit , Michigan	Sutton (1971)	Patents
116	Penick and Ford, Inc.	Construction of corn production and refining plants	1930	Cedar Rapids, Iowa	US House of Representatives, 71st Cong. (1930)	Sutton (1968)
117	Pennsylvania Railroad	Railroad Operating Methods				
118	Petroleum Engineerin Corp.	Petroleum refineries	1936	Tulsa, Oklahoma	Sutton (1971)	Sutton (1971)
119	Pierce, Charles and Co.			Kalamazoo, Michigan		Patents
120	Polakov, W. N.	Management Consultants	1929	New York, New York	Sutton (1971)	Sutton (1971)
121	Pontiac Engineering Corp.	Smelter Construction	1930	Pontiac, Michigan	Sutton (1971)	Patents
122	Pratt & Whitney Aircraft Co.	Stated by Soviets as agricultural implements	1939	West Hartford, Connecticut	Sutton (1971)	National Museum of American History (n.d.k)
123	H. W. Prommel	Geologist in nonferrous metal industry of USSR	1930	Denver, Colorado	US House of Representatives, 71st Cong. (1930)	Patents

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
124	Radio Corporation of America	Exchange of patents and technical information with the Soviet Weak Current Trust	1927	New York, New York	Santalov and Segal (1929)	American-Russian Chamber of Commerce (1931)
125	Radiore Co	Assistance to United Non ferrous Metals Industries in location of ore deposits	1930	Los Angeles, California	US House of Representatives, 71st Cong. (1930)	Ropes (1944)
126	Remington Rand, Inc.	Office Equipment				
127	Republic Aviation Corp.	Aircraft	1932	Farmingdale, New York	Sutton (1971)	United States Arms Control and Disarmament Agency (1966)
128	Richard Bros.	Tractor manufacture				
129	Roberts & Schaefer Co	Donetz Coal Trust	1929	Chicago, Illinois	Sutton (1968)	Ropes (1944)
130	Rockwell, W. S., Co.	Furnace technology at Stalingrad	1930	New York, New York	Sutton (1971)	National Museum of American History (n.d.o)
131	Rosoff Subway Construction Co.	Subway Construction	1929	New York, New York	Sutton (1971)	Sutton (1971)
132	Rust Brothers	Rust cotton-picking machines	1936	New Llano, Louisiana	Sutton (1971)	Patents
133	Safety Mining Co.	Manufacture of CARDOX		Chicago, Illinois	Sutton (1971)	Sutton (1971)
134	Sauerman Bros., Inc.	Equipment Operation	1931	Chicago, Illinois	Sutton (1971)	Sutton (1971)
135	Sayer, E. Y., Engineering Corp.	Steam electric plant	1929		US House of Representatives, 71st Cong. (1930)	
136	C. A. Schnieder	Engineer for construction machinery	1930		US House of Representatives, 71st Cong. (1930)	
137	C.F. Seabrook Co	Advisers for road building		New York, New York		Ropes (1944)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
138	Seiberling Rubber Co	Constructing of a rubber tire plant for Rezinotrest (Soviet Rubber Trust)	1929	Akron, Ohio	US House of Representatives, 71st Cong. (1930)	Ropes (1944)
139	Seversky Aircraft Corp	Aircraft	1937	New York, New York	Sutton (1971)	Sutton (1971)
140	Sharples Specialty Co.	Petroleum centrifuge equipment	1930	Philadelphia, Pennsylvania	Sutton (1971)	Patents
141	Frank Smith Co., Inc.		1929	Brooklyn, New York	Sutton (1968)	Patents
142	Southwestern Engineering Corporation	United Non-ferrous Metals Industries in the design, construction and operation of concentration plants	1930	Los Angeles, California	Sutton (1968)	American-Russian Chamber of Commerce (1931)
143	Sperry Gryoscopic Engineering Corporation	Manufacture of marine instruments	1928	Brooklyn, New York	US House of Representatives, 71st Cong. (1930)	US House of Representatives, 71st Cong. (1930)
144	Standard alcohol Co.	Rubber technology		Wilmington, Delaware		Patents
145	Standard oil Co. of New York	Operation of Batum refinery	1927	New York, New York	Sutton (1968)	National Museum of American History (n.d.l)
146	W. Stevenson	Engineer for forge plants	1929		US House of Representatives, 71st Cong. (1930)	
147	E. J. Stirniman	Specialist in [scientific] farming	1929	Davis, California	US House of Representatives, 71st Cong. (1930)	Online Archive of California (2015)
148	C. H. Strath	Engineer for construction of heat-treating department of tractor plant	1929		US House of Representatives, 71st Cong. (1930)	
149	Stuart, James, & Cooke.	coal industry in the Donetz and Kuznets Basins	1929	New York, New York	Santalov and Segal (1929)	Ropes (1944)
150	Sullivan Co.	Mining Equipment	1923	Claremont, New Hampshire	Sutton (1968)	Library of Congress (n.d.)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
151	Swasey, Warner P.	Tractor manufacture	1932	Cleveland, Ohio	Sutton (1971)	US House of Representatives, 71st Cong. (1930)
152	Szepesi, Eugene, Consulting Management Engineers	Accounting system in textile mills	1931	New York, New York	US Department of State (1980)	American-Russian Chamber of Commerce (1931)
153	Taft Pierce Co.	Technical Assistance in consruction of sewing machine factory	1929	Woonsocket, Rhode Island	US House of Representatives, 71st Cong. (1930)	Syracuse University (2016)
154	Thew Shovel Co.	Dragline Operation	1931	Lorain, Ohio	Sutton (1971)	Sutton (1971)
155	Timken-Detroit Axle Co	Technical Assistance in the Avtotrest		Detroit , Michigan		American-Russian Chamber of Commerce (1931)
156	Tube Reducing Co	Tube Mills Instillation	1938	Wallington, New Jersey	Sutton (1971)	Patents
157	Underwood Typewriter Co.		1929	New York, New York	Sutton (1968)	National Museum of American History (n.d.m)
158	Union Construction Co.	Drawings and specifications for dredges	1925	Oakland, California	US House of Representatives, 71st Cong. (1930)	Hines (1919)
159	Union Switch and Signal Co.	Railroad automatic block signals	1928	Swissvale, Pennsylvania	Sutton (1971)	Levinson (1996)
160	United Engineering and Foundry Co.	Hot and Cold wide-strip mills in steel and aluminum industries	1938	Pittsburgh, Pennsylvania	Sutton (1971)	Naleszkiewicz (1966)
161	Universal Oil Products Inc.	Refinery Construction				
162	U.S. Wheel Track Layer Corp.	Christie Tank				
163	Warren, G. W., Co.					
164	Webber and Wells Inc.	Food processing	1930	Chicago , Illinois	Sutton (1968)	American-Russian Chamber of Commerce (1931)
165	Westinghouse Co.	Powert-plant design, aviation test equipment	1925	Pittsburgh, Pennsylvania	Sutton (1968)	National Museum of American History (n.d.n)

Table A1: Dating and Locating US-USSR Technology Transfer Agreements (continued)

No.	Firm	TTA Description	Year	Location	Source for Year	Source for Location
166	Westvaco Chlorine Products	Aid in production of chlorine for United Chemical Industries	1930	Charleston, West Virginia	US House of Representatives, 71st Cong. (1930)	Ropes (1944)
167	Archer E. Wheeler & Associates	Assistance to the United Non-Ferrous Metal Industries	1930	New York, New York	US House of Representatives, 71st Cong. (1930)	American-Russian Chamber of Commerce (1931)
168	J. G. White Engineering Co.	Consulting Services for Svir hydroelectric plant		New York, New York		Patents
169	Wilson, M. L.					
170	Norman L. Wimmer Co.	United Non-Ferrous Metals Industries for mines near Irkutsk	1930		US House of Representatives, 71st Cong. (1930)	
171	Winklerr-Koch Engineering Co.	Cracking Technology		Wichita, Kansas		American-Russian Chamber of Commerce (1931)
172	W. A. Woods	United Non-Ferrous Metals Industries for mines near Leningrad		Philadelphia, Pennsylvania		American-Russian Chamber of Commerce (1931)
173	Yukon Fur Farms, Inc.	Organization of animal farms	1930	Petersburg, Alaska	Sutton (1971)	US House of Representatives, 71st Cong. (1930)

B Robustness Checks

This Online Appendix section explore robustness of the main results in Table 2. Table B1 drops each of the six cities with the most TTAs one at a time, showing that no one outlier is driving the results (though dropping Chicago has the largest effects on the point estimate). Table B2 estimates the same regression as in Table 2 but only using counties that sign at least one TTA, to show that the results are not sensitive to dropping counties which do not sign a TTA. Finally, the tables in Online Appendix B.1 repeat all these exercises again but using just data from the period surrounding the first Five Year Plan, [1926-1933], to show that TTAs from early in the 1920s which were more agricultural in nature are also not driving the results.

Table B1: Local Financial Distress Induces U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union [1920-1936]: Dropping the Six Cities With the Most TTAs in Figure 1

	(1) No NYC	(2) No Chicago	(3) No Detroit	(4) No Cleveland	(5) No Pittsburgh	(6) No Philadelphia
Bank Failures	0.007*	0.004*	0.006*	0.006*	0.006*	0.006*
	(0.003)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
Observations	51748	51799	51816	51816	51816	51816
R^2	0.142	0.132	0.152	0.151	0.149	0.154
County Fixed Effects	X	X	X	X	X	X
Year Fixed Effects	X	X	X	X	X	X

Notes: Standard errors in parentheses, clustered by U.S. State. This table explores robustness of the main results in Table 2 to dropping the counties with the most TTAs in Figure 1 one at a time (for counties which are part of large cities like NYC and Chicago, we drop all associated counties). The dependent variable is the total number of TTAs signed. This table estimates the total number of TTAs signed by U.S. Firms in county i at time t as a linear function of county-level bank failures measured as bank suspensions. All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.

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

Table B2: Local Financial Distress Induces U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union [1920-1936]: Only Counties Which Sign at Least One TTA

	(1) TTAs	(2) TTAs	(3) TTAs
Bank Failures	0.086***	0.079***	0.064***
	(0.013)	(0.012)	(0.011)
Observations	1054	1054	1054
R^2	0.055	0.116	0.306
County Fixed Effects		X	X
Year Fixed Effects			X

Notes: Standard errors in parentheses, clustered by U.S. State. This table explores robustness of the main results in Table 2 to dropping all counties which never sign a TTA with the Soviet Union. The dependent variable is the total number of TTAs signed. This table estimates the total number of TTAs signed by U.S. firms in county i at time t as a linear function of county-level bank failures measured as bank suspensions. All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

B.1 Estimating Regressions On Years [1926-1933] Only

Table B3: Local Financial Distress Induces U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union [1926-1933]

	(1) TTAs	(2) TTAs	(3) TTAs
Bank Failures	0.013**	0.006**	0.007**
	(0.004)	(0.002)	(0.002)
Observations	24392	24392	24392
R^2	0.030	0.274	0.278
County Fixed Effects		X	X
Year Fixed Effects			X

Notes: Standard errors in parentheses, clustered by U.S. State. The dependent variable is the total number of TTAs signed. This table estimates the total number of TTAs signed by U.S. firms in county i at time t as a linear function of county-level bank failures measured as bank suspensions. All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

Table B4: Local Financial Distress Induces U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union [1926-1933]: Only Counties Which Sign at Least One TTA

	(1) TTAs	(2) TTAs	(3) TTAs
Bank Failures	0.108***	0.079***	0.071***
	(0.017)	(0.014)	(0.016)
Observations	496	496	496
R^2	0.049	0.192	0.380
County Fixed Effects		X	X
Year Fixed Effects			X

Notes: Standard errors in parentheses, clustered by U.S. State. This table explores robustness of the main results in Table 2 to dropping all counties which never sign a TTA with the Soviet Union. The dependent variable is the total number of TTAs signed. This table estimates the total number of TTAs signed by U.S. firms in county i at time t as a linear function of county-level bank failures measured as bank suspensions. All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

Table B5: Local Financial Distress Induces U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union [1926-1933]: Dropping the Six Cities With the Most TTAs in Figure 1

	(1) No NYC	(2) No Chicago	(3) No Detroit	(4) No Cleveland	(5) No Pittsburgh	(6) No Philadelphia
Bank Failures	0.007**	0.004*	0.006*	0.006*	0.007**	0.006*
	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)
Observations	24352	24376	24384	24384	24384	24384
R^2	0.267	0.240	0.273	0.271	0.275	0.278
County Fixed Effects	X	X	X	X	X	X
Year Fixed Effects	X	X	X	X	X	X

Notes: Standard errors in parentheses, clustered by U.S. State. This table explores robustness of the main results in Table 2 to dropping the counties with the most TTAs in Figure 1 one at a time (for counties which are part of large cities like NYC and Chicago, we drop all associated counties). The dependent variable is the total number of TTAs signed. This table estimates the total number of TTAs signed by U.S. firms in county i at time t as a linear function of county-level bank failures measured as bank suspensions. All regressors are standardized and interpretable as the marginal effects of increasing the regressor in question by one standard deviation.

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

C Instrumenting for Credit Supply Following the Approach in Calomiris and Mason (2003a)

In the main text, bank failures are used as a proxy for measuring firms' financial distress. As such, the main text provides evidence that financial distress induces firms to sign TTAs, without taking a stance on whether bank failures (and firms' financial distress) are rising due to a shock to local demand conditions, or a shock to credit supply. This section provides suggestive evidence that a negative shock to credit supply, as experienced during the contraction from 1930-1932, raises the number of TTAs signed by U.S. firms.

To do so, we replicate the approach in Calomiris and Mason (2003a), who show how to construct instruments to study exogenous changes in credit supply (measured as log growth in loans or deposits) between 1930 to 1932 which are uncorrelated with shocks to credit demand over the same period. Those authors studied the effects of local credit supply shocks on local incomes and economic activity, and we will here look at the number of firms which signed TTAs. Note that we only replicate their approach with state level data, as their county level data is not publicly available. At the state level, we can compute two of their three credit supply instruments from publicly available data: the log of total assets per bank in 1929, and total bank net worth over total assets, also in 1929.[9] See Calomiris and Mason (2003a) for the argument that these instruments for credit supply are uncorrelated with credit demand from 1930 to 1932.

Table B6 reports the first stage, which should be compared to Table 3 in Calomiris and Mason (2003a). The log of total assets per bank instrument is somewhat stronger, and the net worth instrument somewhat weaker, than what is reported in their Table 3 (this could be driven by the absence of the third instrument, which we cannot compute, as well as the fact that we have one additional state in our dataset). We also note that the F-statistic is slightly higher for deposits, and we report results for both deposit growth and loan growth following Calomiris and Mason (2003a).

In Table B7, we replicate their specification and estimate the effects of an exogenous change in credit supply, measured as the log growth in deposits or loans from 1930 to 1932, on the change in TTAs signed between 1930 and 1932 at the state level (as opposed to the change in state income), controlling for the change in TTAs signed from 1929 to 1930 (again, instead of the change in state income). Because we still have many zeros in each year, even at the state level, we do not compute the percentage change in TTAs over each of these time periods but instead just take the difference.

The results in Table B7 suggest that a decline in credit supply raises the number of TTAs signed in a state. The estimates are similar for both deposits and loans, as Calomiris and Mason (2003a) found in their results for income. The point estimates imply that a 1% increase in the growth of deposits (or loans) in a state would raise the expected number of TTAs signed by about 0.05 (implying that a 1% increase in the growth of deposits or loans in all 48 states in sample would lower the expected number of TTAs signed by about $48 \times .05 = 2.4$).

[9] For these we use the publication, "All-Bank Statistics, United States, 1896-1955," which the Board of Governors of the Federal Reserve System published in 1959; we use the data digitized by Cao and Richardson (2022) on ICPSR.

Table B6: First Stage: Instruments for Deposit vs. Loan Growth

	(1) Deposit Growth 1930-32	(2) Loan Growth 1930-32
Log Total Assets per Bank 1929	0.10***	0.10***
	(0.02)	(0.02)
Net Worth over Total Assets in 1929	0.13	-0.75
	(0.72)	(0.82)
Observations	48	48
R^2	0.34	0.25
F-stat	17.88	13.11

Notes: Standard errors in parentheses. Growth rates are log changes.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$

Table B7: A Decline in Local Credit Supply May Induce U.S. Firms to Sign Technology Transfer Agreements (TTAs) with the Soviet Union: Deposit vs. Loan Growth

	Effect on Change in TTAs 1930-1932			
	(1) OLS	(2) IV	(3) OLS	(4) IV
Deposit Growth 1930-32	0.01	-5.60*		
	(1.10)	(2.57)		
TTA Change 1929-30	-0.09	-0.14	-0.09	-0.11
	(0.26)	(0.23)	(0.26)	(0.24)
Loan Growth 1930-32			-0.07	-5.04*
			(0.96)	(2.36)
Observations	48	48	48	48

Notes: Standard errors in parentheses. Growth rates are log changes; TTA changes are in first-differences due to many zeros in the data.
Stars indicate: * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$