Estimating the Macroeconomic Effects of Each Totalization Agreement

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Acknowledgements

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Abstract

Totalization agreements coordinate the United States Social Security program with other countries' comparable programs. We estimate each totalization agreement's impact on a variety of bilateral trade outcomes. We find the impact is quite heterogeneous, both across agreements/countries and across sectors within a country. Moreover, we find agreements that entered into force more recently tend to increase total imports and decrease total exports by more than earlier agreements. We find no significant relationship between totalization agreements' estimated impacts and economic indicators such as the trade complementarity index between the U.S. and the agreement countries. Finally, we find sectors where the U.S. has a larger revealed comparative advantage relative to the agreement country tend to experience a larger increase in exports following the totalization agreement. However, there is no significant relationship between revealed comparative advantage and the estimated impact on imports across sectors. In future work, we will investigate in more detail both the correlation between the heterogeneity across sectors within a country and the heterogeneity across countries, as well as the correlation between totalization agreements and the declining U.S. trade balance in the past few decades.

Citation

Introduction

Beginning in the late 1970s, the United States established a network of Social Security agreements that coordinate the U.S. Social Security program with the comparable programs of other countries.[1] These international social security agreements, often called the "totalization agreements," have three main purposes. First, they eliminated dual social security taxation, the situation that occurs when a worker from one country works in another country and is required to pay social security taxes to both countries on the same earnings. Second, the agreements help fill gaps in benefit protection for workers who have divided their careers between the U.S. and another country. Finally, the totalization agreements permit unrestricted benefit payments to residents of the two countries.

Conceptually, by reducing the tax and increasing benefit protection for U.S. citizens working in other countries and vice versa, the totalization agreements should have a positive effect on U.S. citizens working in countries that have signed such an agreement with the U.S., as well as the citizens from those countries working in the U.S. By promoting international labor mobility, the totalization agreements could also affect other macroeconomic outcomes such as bilateral trade and foreign direct investment (FDI).

Empirically, Seshadri (2019) finds that, on average, the totalization agreements reduce U.S. exports and increase U.S. imports and FDI, with the effects on exports being more significant both economically and statistically. The effects are estimated to

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[1] This introductory paragraph draws from the description by the Social Security Administration: https://www.ssa.gov/international/agreements_overview.html.

be quite heterogeneous across countries/agreements. For example, although most of the totalization agreements are estimated to reduce U.S. exports, the estimates suggest an increase in U.S. exports due to the totalization agreements with countries such as Finland, Ireland, and the Czech Republic. Similarly, contrary to the average effect that sees an increase in U.S. imports, the estimates suggest a decrease in U.S. imports due to the totalization agreements with countries such as Italy, Germany, Norway, Sweden, Portugal, South Korea, and Australia.

The goal of this paper is to provide a better understanding of the macroeconomic effects of each totalization agreement. Motivated by Seshadri (2019), we focus on the totalization agreements' heterogenous effects on bilateral trade and proceed in three steps.

First, we use the synthetic control method to estimate the impact of each totalization agreement. In addition to the impacts on total exports and total imports as in Seshadri (2019), we also estimate the impacts on exports and imports by sector (two-digit Standard International Trade Classification code).[2] Moreover, we measure the credibility of each synthetic control estimate using the associated root mean squared prediction error. Less credible estimates are ignored. Overall, the results from this step are similar to those in Seshadri (2019): The impact is estimated to be heterogeneous across agreements; on average the agreements decreased total exports by more than they increased total imports; the impact is also heterogeneous across sectors.

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[2] All exports and imports mentioned in this paper are bilateral between the U.S. and the countries with which the U.S. has a totalization agreement, and they are measured from the perspective of the U.S. For example, when discussing the totalization agreement between the U.S. and Italy, total exports refer to the total exports from the U.S. to Italy, and total imports refer to the total imports from Italy to the U.S. The exports and imports by sector are defined accordingly.

Second, we investigate the patterns underlying the heterogeneity across the estimated impacts on total exports and total imports. We find agreements that entered into force more recently tend to increase total imports and decrease total exports by more than earlier agreements. We find no significant relationship between totalization agreements' estimated impacts on bilateral trade and economic indicators such as the trade complementarity index between the U.S. and the agreement countries.

Finally, we move beyond the heterogeneity across agreements/countries and explore the patterns underlying the heterogeneous impacts across sectors within an agreement/country. We find that sectors where the U.S. has a larger revealed comparative advantage relative to the agreement country tend to experience a larger increase in exports following the totalization agreement. However, there is no significant relationship between revealed comparative advantage and the estimated impact on imports across sectors.

In short, this paper makes two key findings: (1) more recent totalization agreements tend to increase total imports and decrease total exports by more than earlier agreements; and (2) within an agreement and regardless of implementation date, sectors where the U.S. has a larger revealed comparative advantage tend to experience a larger increase in exports following the totalization agreements.

The findings contribute to the understanding of how totalization agreements affect bilateral trade. They raise some interesting questions for future research, some of which are discussed at the end of the paper.

While this paper focuses on bilateral trade, we have also done similar analyses for FDI and international labor mobility. Partly because of data limitations, we find no

systematic pattern regarding these two outcomes. Instead of reporting the details, we summarize the main results briefly here.

We confirm the findings in Seshadri (2019) that the effect on FDI is quite heterogeneous across agreements/countries. However, we find no systematic pattern underlying this heterogeneity. For example, there is no significant relationship between a totalization agreement's implementation date and its impact on FDI. Part of the reason is because FDI is very volatile, making it hard to obtain a credible synthetic control estimate.

Unlike bilateral trade and FDI, official data on international labor mobility is limited. We thus turn to the American Community Survey (ACS), even though it has two limitations, First, the ACS is only available since 2000. Because five years of data before and after the implementation of a totalization agreement is needed, we can only use the data to estimate the impacts of the agreements with Japan, Denmark, Czech and Poland. Secondly, like any household survey, the ACS may contain significant measurement errors, especially for the number of immigrants from relatively small countries. Partly for this reason, our estimates for the four countries mentioned above are not very precise. One option we could pursue in the future is to use the data on visa issuance from the U.S. State Department.

Data

The main data used in this paper are annual trade (exports and imports) values between the U.S. and other countries, obtained from the UN Comtrade Database.[3] In

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[3] https://comtrade.un.org/data/

addition to total exports and imports, we also use the exports and imports by two-digit

Standard International Trade Classification (SITC) code. To calculate relevant trade

indicators, we also use the trade values between each country and the rest of the world.

The date that each totalization agreement entered into force is obtained from the

Social Security Administration.[4]

Empirical strategy

We proceed in two steps. First, we use the synthetic control method to estimate

the impact of each totalization agreement on a variety of bilateral trade outcomes.

Second, to understand the heterogeneity in the estimated impacts, we relate the

synthetic control estimates to relevant economic/trade indicators.

Developed recently by Abadie and Gardeazabal (2003) and Abadie, Diamond and

Hainmueller (2010, 2015), among others, the synthetic control method has been

described by Athey and Imbens (2017) as "arguably the most important innovation in

the policy evaluation literature in the last 15 years." Abadie (forthcoming) provides a

detailed discussion of the method and the related literature.

In the rest of this section, we describe our implementation of the synthetic control

method, which is similar to that of Seshadri (2019). The differences between the two

papers will be highlighted. The economic/trade indicators will be described later when

we discuss the synthetic control estimates.

Suppose there is a sample of $I + 1$ countries indexed by i, among which $i = 1$ is

the only country with which the U.S. has established a totalization agreement which

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[4] https://www.ssa.gov/international/agreements_overview.html

entered into force in year T_i. The synthetic control estimator of the agreement's impact on outcome variable y in year t is

$$y_{1t} - \sum_{i>1} w_i y_{it} \tag{1}$$

where w_i is the weight of country i such that $\sum_{i>1} w_i = 1$ and each w_i is between 0 and 1.

Let X_i be a vector of preagreement, i.e., before the year T_i, characteristics of country i, and let X_{im} be its mth element. The optimal weight w_i is chosen by minimizing the following criterion function

$$\sum_m v_m \left(X_{1m} - \sum_{i>1} w_i X_{im} \right)^2 \tag{2}$$

where v_m is the relative importance of the mth element. An optimal choice of v_m minimizes the mean squared error of the synthetic control estimator.

Essentially, for the treated country $i = 1$, the method constructs a synthetic control by properly weighting each of the potential control countries such that the resulting synthetic control country mimics the behavior of the treated country before the totalization agreement entered into force. The totalization agreement's effects are then measured by the differences in the outcome variable between the treated and the synthetic country in the years since the agreement.

Because the synthetic control country is meant to approximate the counterfactual of the treated country $i = 1$ in the absence of the totalization agreement, it is important to restrict the pool of potential controls to countries similar to the treated country $i = 1$ in the sense that the outcome variable y is driven by the same structural process in both the treated country and the potential control countries. For example, in evaluating the

effect of the totalization agreements on trade, Zimbabwe may not be a good control for Italy if the trade patterns between Zimbabwe and the U.S. are significantly different from those between Italy and the U.S. On the other hand, France may be a better control if its trade patterns with the U.S. are similar to those between Italy and the U.S.

Given that the bilateral totalization agreement between the U.S. and other countries entered into force at different times, a natural group of potential controls for a particular treated country are countries that signed the totalization agreement with the U.S. in later years. For example, the first totalization agreement signed between the U.S. and Italy entered into force on November 1, 1978. Countries that have signed a totalization agreement with the U.S. since then are arguably better controls for Italy in estimating the totalization agreement's effects than other countries that have never signed a totalization agreement with the U.S.

By definition, however, a potential control should not have a totalization agreement with the U.S. during the evaluation period. We thus exclude the countries that have signed a totalization agreement with the U.S. before the end of the evaluation period, and only use the countries that have signed a totalization agreement with the U.S. afterward as potential controls. For example, if we want to estimate the totalization agreement's effects between Italy and the U.S. from 1978 to 1983, we would exclude (former Federal Republic of) Germany and Switzerland, which signed totalization agreements with the U.S. in 1979 and 1980, respectively, and use other countries that signed a totalization agreement with the U.S. since 1984 as potential controls.

Specifically, for each country of interest that has signed a totalization agreement with the U.S., we use 11 years of data: the year when the agreement entered into force

normalized to be year zero $t = 0$ in the results reported below, and five years before

$(-5 \leq t \leq -1)$ and after $(1 \leq t \leq 5)$ that. We use countries that have signed a

totalization agreement with the U.S. five years after the country of interest as potential

controls, and choose the weights such that the resulting weighted average (the

synthetic control) mimics the behavior of the country of interest in the five years leading

to the totalization agreement. This is operationalized using equation (2) where X_i

includes the values of the outcome variable of interest in the five years before the

agreement $y_{it<0}$. This is different from Seshadri (2019) where X_i also includes other

country characteristics like real GDP, population, and distance from the U.S., which are

ignored in this paper because we find their impacts on the estimates to be minimal. With

the synthetic control given by the weight for each country w_i, we then use equation (1)

to estimate the effect of the totalization agreement for $t \geq 0$.

For trade outcomes, in addition to total exports and total imports studied in

Seshadri (2019), we also include their components broken down by two-digit SITC

codes. All outcomes are measured from the perspective of the U.S. That is, exports and

imports are the U.S. exports to and imports from another country, respectively. As the

trade data are relatively volatile, especially for some two-digit SITC codes, we use a

five-year moving average to limit the influence of temporary shocks. Moreover, for each

treated country and its potential controls, we normalize the value of each outcome

variable in the year before the agreement entered into force to be one. The values in

other years are relative to the year before the agreement entered into force, $t = -1$.

This allows us to focus on the impact of the totalization agreements on the growth of

each outcome variable. Specifically, let y_{it}^d be the value of a trade outcome i in year t

observed in data. We first calculate the five-year moving average as $y_{it}^m = \frac{1}{5}\sum_{s=t-4}^{t} y_{is}^d$,

and then normalize it as $y_{it} = \frac{y_{it}^m}{y_{it=-1}^m}$.

In the results reported below, we focus on the impact of the totalization agreement on $y_{it=5}$, estimated from equation (1) evaluated at $t = 5$. The estimate could be interpreted as the impact of the totalization agreement on the growth rate of the outcome variable in the first five years since the agreement entered into force, under the assumption that the synthetic control country represents how the treated country would have behaved in the absence of the totalization agreement. That is, the approach assumes factors other than the totalization agreement, e.g., changes in exchange rates and the adoption of the Euro, have exactly the same effects on both the treated and the synthetic control country, and thus their effects would be differenced out.

One advantage of the synthetic control method is transparency. In particular, we can use the root mean squared prediction error (RMSPE)

$$RMSPE = \sqrt{\frac{1}{5}\sum_{t=-5}^{-1}\left(y_{1t} - \sum_{i>1} w_i y_{it}\right)^2} \tag{3}$$

calculated using data before the totalization agreement to measure how closely the synthetic control mimics the behavior of the outcome of interest in the treated country. RMSPE can be viewed as a measure of how credible a synthetic control estimate is, with smaller RMSPEs indicating more credible estimates. Consequently, in the results reported below, we focus on estimates with relatively small RMSPEs.

By now, the U.S. has signed a totalization agreement with 30 countries. The last one, with Iceland, entered into force on March 1, 2019. Because we need five years of data after the agreement to evaluate its effect and at least one similar country that has

signed an agreement afterward to construct the synthetic control estimation, we cannot evaluate the effect of recently signed agreements. In practice, this includes the six agreements signed since 2014. This leaves us with 24 agreements entered into force between November 1, 1978 (Italy), and March 1, 2009 (Poland). In practice, however, the sample size is smaller due to missing data. First, because the trade data for Luxembourg was combined with that of Belgium around 1993, the year when the totalization agreement between the U.S. and Luxembourg entered into force, we cannot evaluate the effect of this totalization agreement on trade. Secondly, not all countries are trading with the U.S. at the level of each two-digit SITC code, so the sample size could drop significantly when we look at detailed trade components.

RMSPE

This section reports the RMSPEs associated with the synthetic control estimates. The goal is to choose a cutoff value so that estimates whose RMSPEs are above the cutoff value are deemed as not credible enough to be included for further analysis.

To visualize the role of RMSPE, Figure 1 reports the synthetic control estimates of two totalization agreements for the U.S.: the one with Ireland in 1993 and the one with Poland in 2009. The top left panel reports the impact of the agreement with Ireland on total U.S. exports to Ireland in the first five years since the agreement. The synthetic control represented by the dashed line does a great job in mimicking the behavior of the U.S. exports to Ireland in the five years before the agreement was signed. This is summarized/reflected by a small RMSPE of 0.003. In comparison, the RMSPE for the top right panel, illustrating the impact of the agreement with Poland on total U.S. exports to Poland, is much larger at 0.192. This is consistent with the visual impression that the synthetic control in this case does a poor job mimicking the behavior of the treated country in the five years before the agreement was signed. Obviously, the estimated impact of the totalization agreement with Ireland in the top left panel is much more credible than the corresponding estimate for Poland in the top right panel.

Figure 1: Synthetic control estimates for Ireland and Poland
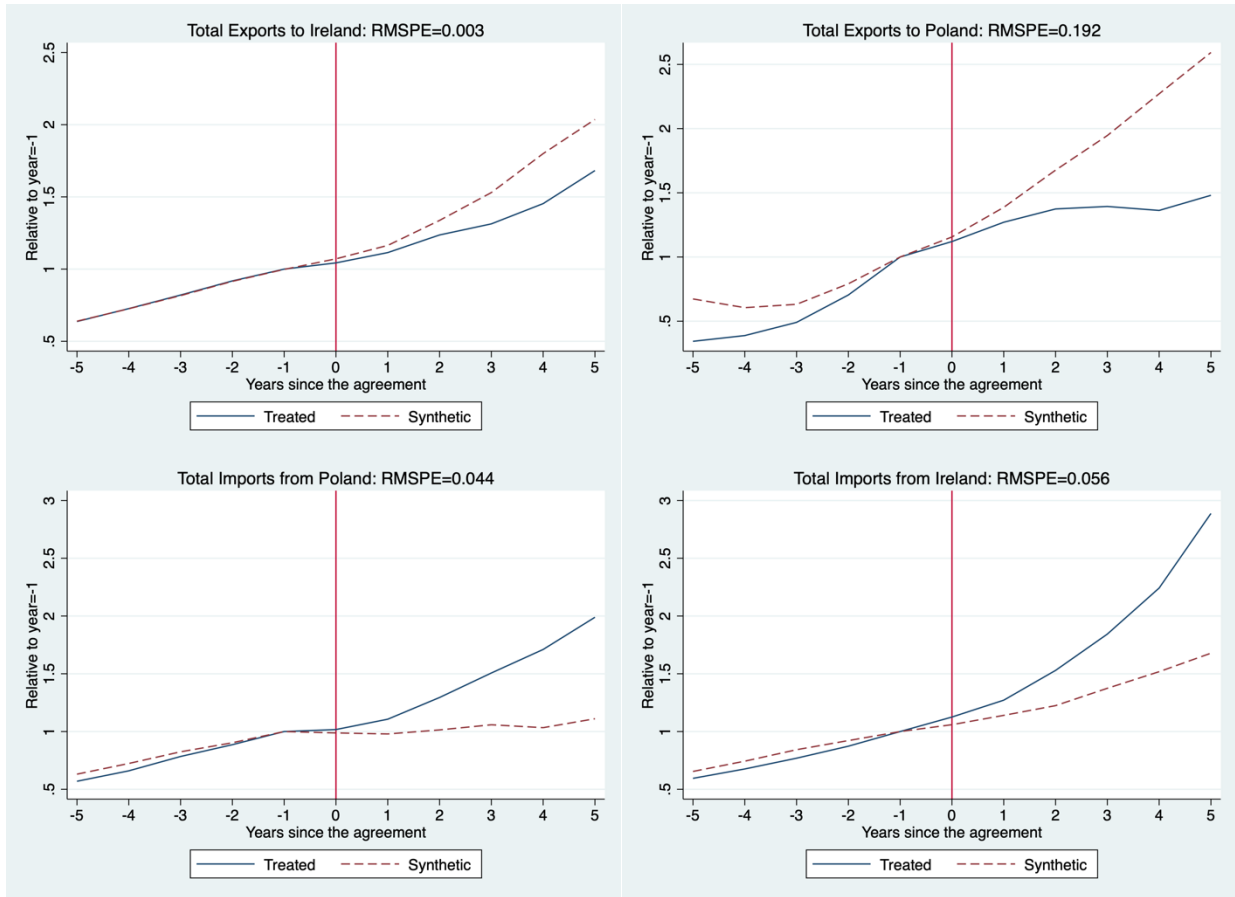
The bottom panels of Figure 1 report the estimated impacts of the two totalization agreements on total U.S. imports from the two countries, respectively. In both cases, the synthetic control does a reasonably good job of mimicking the behavior of the treated country in the five years before the agreement. The RMSPEs for the two cases are both around 0.05. We take this as an indication that estimates with RMSPEs around 0.05 are reasonably credible. As a result, we will restrict our analysis in the next two sections to estimates whose RMSPEs are below 0.05. Estimates whose RMSPEs are at or above 0.05, like those in the two right panels of Figure 1, will be ignored. All results are robust to other cutoff values not too far away from 0.05.

The solid line in Figure 2 plots the cumulative distribution of RMSPEs across all estimates where the outcome variable is either total exports or total imports. Nearly 90% of these estimates are associated with RMSPEs below 0.05. The dashed line is similar but for exports and imports broken down by two-digit SITC code. As the trade values for the subgroups are more volatile, it is harder to obtain good synthetic controls for them. Consequently, fewer than half of the estimates for the subgroups are associated with RMSPEs below 0.05.

Figure 2: Cumulative distribution of RMSPE
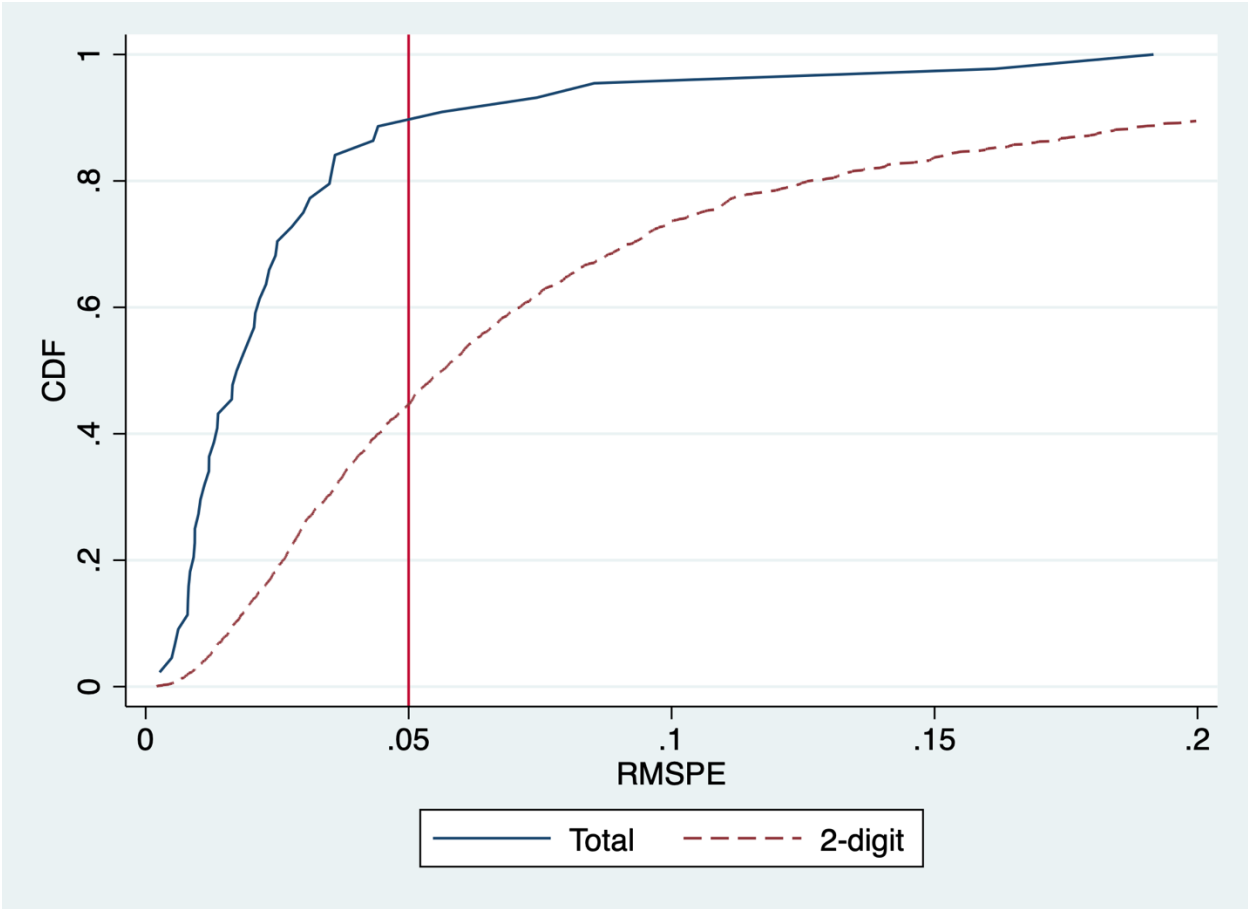
Total exports and total imports

Figure 3 reports the estimated impacts on total exports and total imports for each totalization agreement. As mentioned above, we focus on the impact in the fifth year since the agreement $y_{it=5}$, estimated from equation (1) evaluated at t = 5. Given the data transformation discussed above, the estimate could be interpreted as the impact of the totalization agreement on the growth rate of the outcome variable in the first five years since the agreement entered into force.

Figure 3: Estimated impacts on total exports and imports
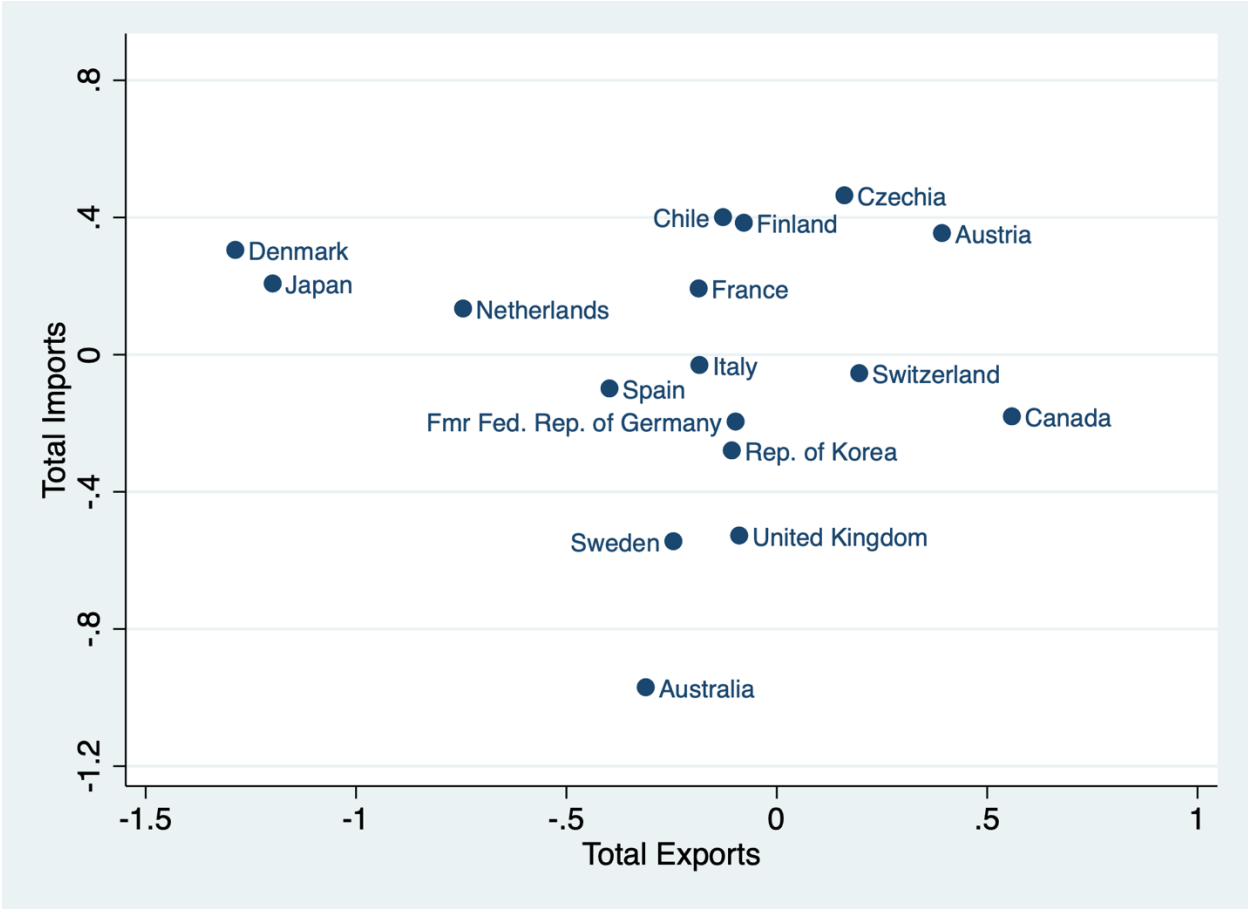
Similar to the estimates reported in Seshadri (2019), Figure 3 shows that the estimated impacts are quite heterogeneous. For total exports, the estimates range from -1.287 to 0.559 with a mean of -0.22. For total imports, the estimates range from -0.97 to 0.465 with a mean of -0.025. Note that countries with only one credible estimate on either total exports or total imports but not both are excluded from Figure 3. The average across all credible estimates on total exports is -0.238, and the average across all credible estimates on total imports is 0.025. These numbers have the same sign as the average effects on total exports and total imports in the fifth year reported in Seshadri (2019), which are -0.505 and 0.134, respectively. The smaller magnitudes are mainly due to the five-year moving average transformation applied in this paper but not in Seshadri (2019).

Figure 3 suggests a negative correlation between the impacts on total exports and the impacts on total imports, and this negative correction is due to the timing of the totalization agreements. For example, the totalization agreements with Denmark and Japan signed since 2005 decreased total exports and increased total imports by more than the agreements with Canada and Switzerland which entered into force in early 1980s.

To see this more directly, Figure 4 plots the two sets of estimates separately against the year when each totalization agreement entered into force. Clearly, the top panel shows a negative association where the totalization agreements signed in more recent years decreased total exports by more than earlier agreements. The slope of the fitted line is -0.021 with a standard error of 0.01 and a p-value of 0.053. The bottom panel, on the other hand, shows a positive correlation where the totalization agreements signed in more recent years increased total imports by more than earlier agreements. The slope of the fitted line is 0.016 with a standard error of 0.01 and a p-value of 0.092.

Figure 4: Estimated impacts on total exports and imports, year of agreement
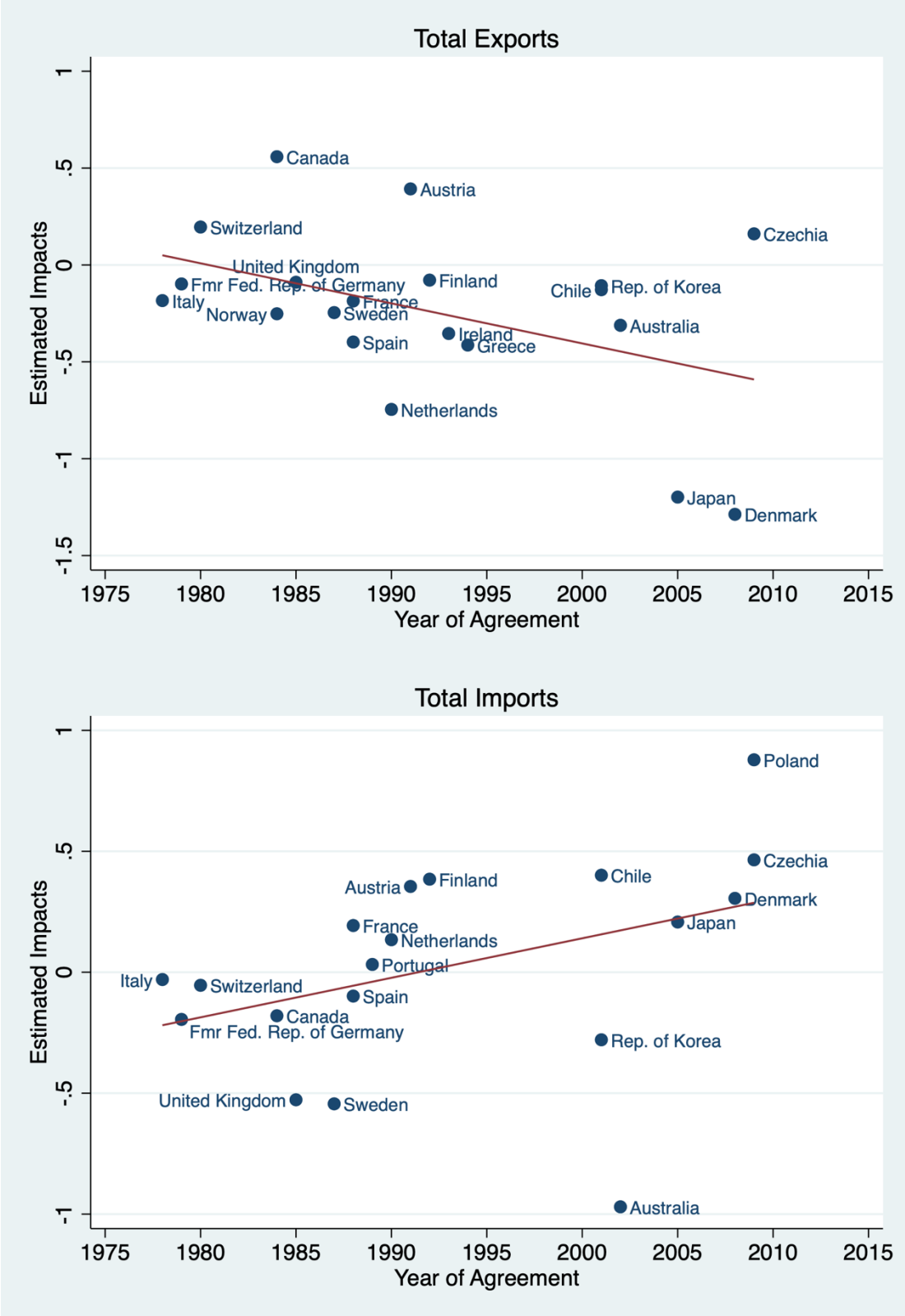
The timing that each totalization agreement entered into force is unlikely to be random. In particular, it seems that, unsurprisingly, the U.S. first signed the totalization agreements with more developed countries such as Canada and those in western Europe before expanding the coverage to include other countries like Chile and South Korea. As a result, the associations shown in Figure 4 may not reflect a causal impact of timing. It is useful to investigate whether and how the estimated impacts reflect other country characteristics.

One characteristic we consider here is the trade complementarity index (TCI) between the U.S. and the agreement countries. TCI provides useful information on prospects for bilateral trade in that it shows how well the structures of a country's imports and exports match the structures of another country's exports and imports.[5] Specifically, the index between countries i and j in year t is defined as:

$$TCI_{ijt} = 1 - \frac{1}{2} \sum_k \left| m_{ikt} - x_{jkt} \right|$$

where m_{ikt} is the share of good k in global imports of country i in year t and x_{jkt} is the share of good k in all exports of country j in year t. The index is zero when no goods are exported by one country or imported by the other and 1 when the import shares of country i match the export shares of country j perfectly.

For each totalization agreement, let j be the U.S., i be the agreement country, and t be the year before the agreement entered into force, as is the case for the TCI plotted on the horizontal axis of the top panel in Figure 5. A natural hypothesis is that there is a

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[5] This paragraph is adapted from the following site, which also describes a list of other trade indicators such as the revealed comparative advantage discussed in the next section: https://wits.worldbank.org/wits/wits/witshelp/Content/Utilities/e1.trade_indicators.htm

positive association between TCI and the estimated impact on total exports. This is not

borne out in data, as suggested by the insignificant relationship between the two

variables in the top panel. Similarly, let i be the U.S. and j be the agreement country, as

is the case for the TCI plotted on the horizontal axis of the bottom panel in Figure 5. We

might expect a positive association between TCI and the estimated impact on total

imports. This is not borne out in data either, as suggested by the insignificant

relationship between the two variables in the bottom panel.

Figure 5: Estimated impacts on total exports and imports, complementarity
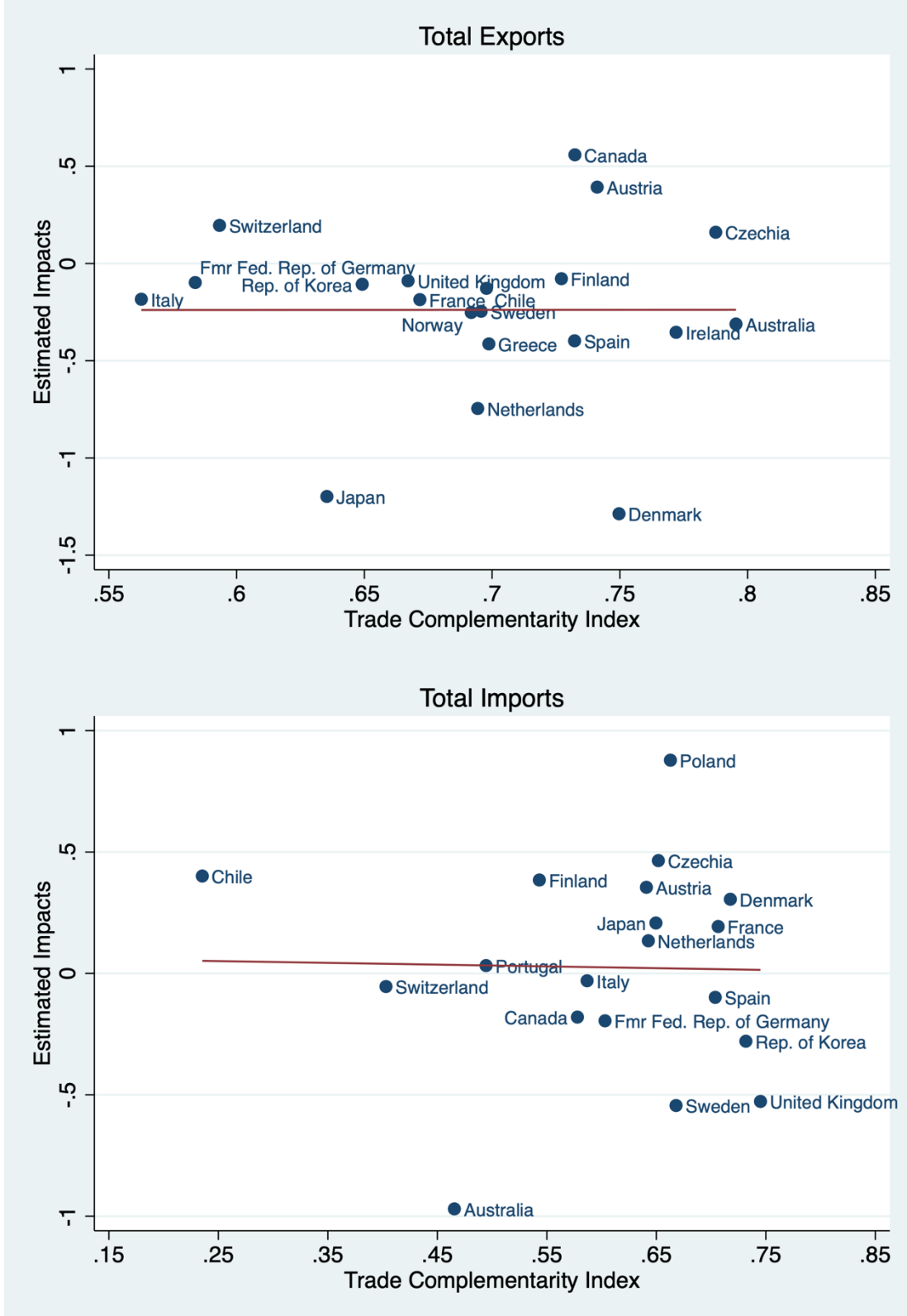
In short, relative to Seshadri (2019), who finds heterogeneous impacts of the totalization agreements on both U.S. exports to and imports from the agreement country, we find the impacts on both exports and imports are significantly correlated with the year when a totalization agreement entered into force, with newer agreements decreasing total exports and increasing total imports by more than earlier agreements. We also find no significant correlation between the estimated impacts and the TCI between the U.S. and the agreement countries.

Exports and imports by sector

To better understand the impacts of the totalization agreements, we move beyond total exports and total imports by estimating the impact for each sector defined by a two-digit SITC code and relating the estimate to a modified measure of revealed comparative advantage (RCA).

RCA measures have been used to help assess a country's export potential. The RCA indicates whether a country is in the process of extending the products in which it has a trade potential, as opposed to situations in which the number of products that can be competitively exported is static. It can also provide useful information about potential trade prospects with new partners. Countries with similar RCA profiles are unlikely to have high bilateral trade intensities unless intra-industry trade is involved. RCA measures, if estimated at high levels of product disaggregation, can focus attention on other nontraditional products that might be successfully exported.

For sector k of country i in year t, the traditional measure of RCA index proposed by Balassa (1965) is

$$RCA_{ikt} = \frac{x_{ikt}}{x_{wkt}}$$

where x_{ikt} is the share of sector k in global exports of country i in year t, and x_{wkt} is the share of sector k in world trade in year t.

Because our focus is on bilateral trade, instead of comparing a country with the world, we are more interested in the comparison between two countries. For any countries i and j, we use the ratio of their RCAs as a measure of country i's revealed comparative advantage relative to that of country j:

$$RRCA_{ijkt} = \frac{RCA_{ikt}}{RCA_{jkt}} = \frac{x_{ikt}}{x_{jkt}}$$

We convert the ratio into an index by normalizing it as follows

$$NRRCA_{ijkt} = \frac{RRCA_{ijkt} - 1}{RRCA_{ijkt} + 1}$$

By construction, $NRRCA_{ijkt}$ is between -1 and 1. When it is positive, country i has a revealed comparative advantage relative to country j for sector k in year t. Otherwise, country j has a revealed comparative advantage relative to country i.

In practice, for each totalization agreement, $NRRCA_{ijkt}$ is calculated by setting the U.S. to be i, the agreement country to be j, each two-digit SITC code to be k, and the year before the agreement to be t. We will refer to it simply as the revealed comparative advantage and study its correlations with the estimated impacts of the totalization agreements.

As an example, Figure 6 plots the estimated impact of two totalization agreements on sectorial exports against the corresponding revealed comparative advantage. Each dot represents a sector defined by a two-digit SITC code. Only sectors with credible estimates are plotted. The top panel is for Denmark whose totalization agreement with the U.S. entered into force in 2008. The bottom panel is for (former Federal Republic of) Germany whose totalization agreement with the U.S. entered into force in 1979. These two countries are chosen for two reasons. First, as neighbors, Denmark and Germany are probably more comparable with each other than a random pair of countries. Second, the totalization agreements between the U.S. and the two countries were signed 29 years apart, allowing us to see whether the timing of a totalization agreement has any impact on the correlation between the revealed comparative advantage and the estimated impact on sectorial trade. This is motivated by the previous finding that an agreement's timing is significantly correlated with its impact on total exports and total imports.

Figure 6: Comparative advantage and the estimated impacts on exports

Denmark: 2008

Germany: 1979

Only select sectors marked in solid dots are labelled
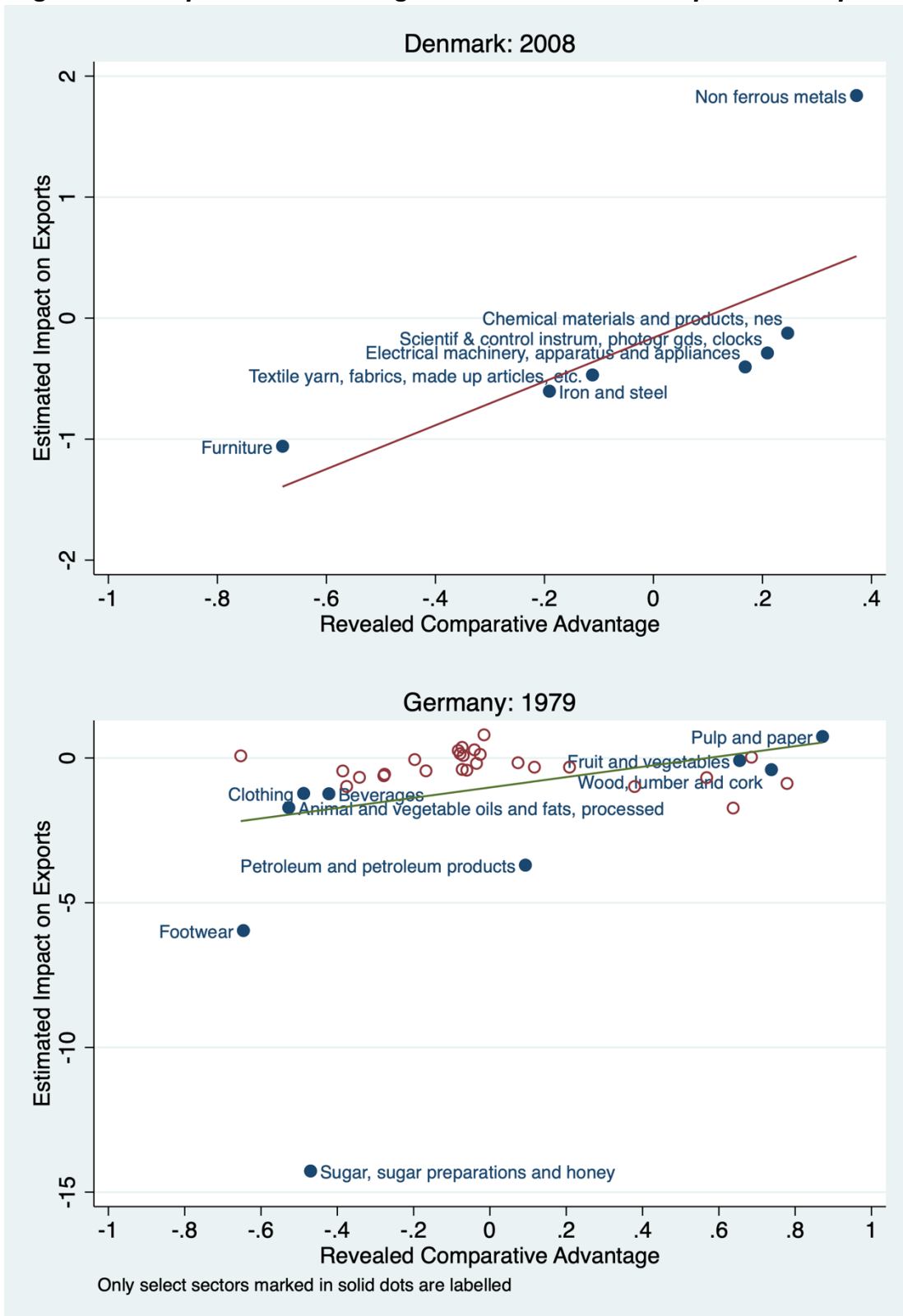
In both cases, there is a positive correlation between the revealed comparative advantage of a sector and the estimated impact of the totalization agreement on the sectorial exports from the U.S. to the agreement country. For Germany, the positive association is robust to the exclusion of the three sectors which decreased exports the most (petroleum and petroleum productions; footwear; and sugar, sugar preparations, and honey). Intuitively, sectors where the U.S. has a larger comparative advantage on average experienced a larger increase in exports due to the totalization agreement. This is true for both agreements signed 29 years apart, suggesting that the relationship is not unique to either the newest or the oldest agreements.

Turning now to imports, Figure 7 suggests that there is no significant relationship between the revealed comparative advantage of a sector and the totalization agreement's estimated impact on the sectorial imports for the U.S. from the agreement country, at least for Denmark and Germany.

Figure 7: Comparative advantage and the estimated impacts on imports

Denmark: 2008

Miscellaneous manufactured articles, nes ●

Leather, lthr. Manufs., nes & dressed fur skins ●

Beverages ●   Plastic materials, etc. ●

Textile yarn, fabrics, made up articles, etc. ●   Machinery, other than electric

Rubber manufactures, nes ●

Non metallic mineral manufactures, nes ●

Scientif & control instrum, photogr gds, clocks ●
Electrical machinery, apparatus and appliances ●

Chemical elements and compounds ●

Special transact. Not class. According to kind ●

Estimated Impact on Imports

Revealed Comparative Advantage

Germany: 1979

● Dairy products and eggs

Furniture ●

Crude fertilizers and crude minerals, nes ●
Medicinal and pharmaceutical products ●

Iron and steel ●   Fruit and vegetables ●

Transport equipment ●
Chemical elements and compounds ●

● Petroleum and petroleum products

● Textile yarn, fabrics, made up articles, etc.
● Beverages

Plastic materials, etc. ●

Estimated Impact on Imports

Revealed Comparative Advantage

Only select sectors marked in solid dots are labelled

25

The patterns in Figure 6 and Figure 7 are not unique, as suggested by the regression results in Table 1, which pools all countries together. Consistent with Figure 6, the upper panel of Table 1 shows a statistically significant relationship between the revealed comparative advantage of a sector and the estimated impact of the totalization agreement on the sectorial exports from the U.S. to the agreement country. In particular, comparisons across the specifications in the three columns suggest that the correlation is robust to the inclusion of both country and sectorial fixed effects. In contrast, but consistent with Figure 7, the three columns in the bottom panel suggest that there is no significant relationship between the revealed comparative advantage of a sector and the estimated impact of the totalization agreement on the sectorial imports for the U.S. from the agreement country.

Table 1: Comparative advantage and the effects of totalization agreements

	(1)	(2)	(3)
Panel A: Exports			
Revealed Comparative Advantage	0.466**	0.357*	0.483**
	(0.196)	(0.204)	(0.245)
Country fixed effects	No	Yes	Yes
Two-digit SITC code dummies	No	No	Yes
_N_	464	464	464
Panel B: Imports			
Revealed Comparative Advantage	-0.016	0.152	-0.372
	(0.308)	(0.330)	(0.414)
Country fixed effects	No	Yes	Yes
Two-digit SITC code dummies	No	No	Yes
_N_	379	379	379

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Standard errors are in the parentheses.

Summary and future work

We estimate the impact of each totalization agreement on a variety of bilateral trade outcomes using the synthetic control method. Consistent with Seshadri (2019), we find the impact is quite heterogeneous, not only across agreements/countries but also across sectors within a country. Moreover, we find agreements that entered into force more recently tend to increase total imports and decrease total exports by more than earlier agreements. We find no significant relationship between the estimated impacts of the totalization agreements and economic indicators such as the trade complementarity index between the U.S. and the agreement countries. Finally, we find that sectors where the U.S. has a larger revealed comparative advantage relative to the agreement country tend to experience a larger increase in exports following the totalization agreement, but there is no significant relationship between revealed comparative advantage and the estimated impact on imports across sectors.

The findings contribute to the understanding of how totalization agreements affect bilateral trade, which could be used to forecast the impact and guide the design of future totalization agreements. For example, if fostering U.S. exports in a particular sector is important, the findings in this paper suggest a totalization agreement with a country where the U.S. has the largest revealed comparative advantage in that sector might help.

The findings also raise some interesting questions for future research. For example: How are the last finding across sectors within a country related to the second finding about the timing of an agreement? In particular, is it the case that more recent agreements tend to involve countries that are more specialized in exporting to the U.S. the goods that they have a larger comparative advantage but are less specialized in importing from the U.S. the goods they have a smaller comparative advantage? Additionally, how are the totalization agreements related to the declining U.S. trade balance over the last few decades? Is it the case that the totalization agreements simply magnify the existing trade balance so that the second finding about timing arises because more recent agreements tend to be implemented when the U.S. trade deficit is larger? We plan to investigate these questions in future work. The answers to these questions could contribute to our understanding of not only the impact of the totalization agreements, but also the relationship between international labor mobility and trade in general, a long-standing topic studied by Mundell (1957), Wong (1986) and Gould (1994), among others.

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