#### Child Mortality and the Unexpected Effect of Deep Trade Agreements

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#### Abstract

This paper studies the impact of the entry into force, for the first time, of Free Trade and Economic Integration Agreements (FTAEIA) on child mortality rates during 1990-2019. We exploit the spatial and temporal variation of the entry into force of these Agreements as a source of exogenous variation. In contrast to expectations, we find that the entry into force, for the first time, of the FTAEIA has an adverse effect on child mortality. As all countries have been experiencing a drop in their mortality rates, although at a slower pace in the last decade, this result implies that the entry into force of the first FTAEIA has led to a slowdown in the reduction of mortality rates in children.

Key words: child mortality, trade openness, heterogenous treatment effects.

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#### 1. Introduction

In the last three decades, mortality in children under five years of age in the world has decreased significantly, from 93 to 38 per thousand live births and the number of deaths in this age range has been reduced to more than half. While large disparities between countries still exist today, the reduction has occurred in all regions of the world, regardless of geographic location and income level. At the same time, the countries have shown greater openness to trade, which is reflected, for example, in the evolution of the number of trade agreements. In particular, of these agreements, the ones that have gained the most relevance are the Free Trade and Economic Integration Agreement (FTAEIA). In 1994, only 17 FTAEIA entered into force for the first time but in 2019 that number increased to 97. This type of agreements, unlike the Free Trade Agreements (FTA) include deeper commercial provisions and are mainly focused on the area of services and the elimination of barriers in this sector. Likewise, these agreements range from those that seek deep integration such as the European Economic Area, NAFTA, MERCOSUR to those more recent (bilateral or plurilateral) that seek the liberalization of specific restrictions on trade in services such as the FTA between the United States and countries of Latin America.

A growing literature has shown that losses from trade liberalization could be deeper, more concentrated, and longer lasting than estimated (Engel, Kokas, Lopez-Acevedo, & Maliszewska, 2021). The evidence shows that the gains from trade liberalization differ between countries, regions, industries and even demographic groups and that the impact of Free Trade Agreements is quite heterogeneous (Baier et al., 2016).

Regarding the impact on child mortality, the evidence is mixed. Various investigations have found that greater trade openness reduces mortality in boys and girls through different mechanisms such as poverty reduction and greater access to nutritious food and health services, among others (Panda, 2018) (Levine & Rothman, 2006) (McNeill, et al., 2017) (Bokhari, Gai, & Gottret, 2007) (Moreno-Serra & Smith, 2015). However, there would also be undesirable effects that could lead to an increase in child mortality. According to the literature, these effects would occur through various mechanisms such as increased drug costs (Stiglitz, 2009), pollution (Bombardini & Li, 2016), alcohol and tobacco consumption among parents (Friel, et al., 2013); and the adoption of unhealthy lifestyles (Baggio & Chong, 2020) (Missoni, 2013) (Swinburn, et al., 2011) (Baker, Kay, & Walls, 2014). Nevertheless, most of the existing studies use the Frankel & Romer instrument (trade openness as percentage of GDP) or the Sachs-Warner/Wacziarg-Welch measure of liberalization (classification based on five indicators related to the level of tariffs, economic system, among other aspects). This, despite the fact that these measures of trade openness present deep problems and are inappropriate measures of trade policy openness (Rodríguez and Rodrik 1999; Rodríguez 2006).

The purpose of our research is to explore the impact of the most important dimension of trade reform in the last 20 years on the under-five mortality rate- one of the most important indicators of health status in a country and commonly used to identify the most vulnerable populations and compare socioeconomic development between countries (World Bank, 2017). Specifically, we study the causal effect of the entry into force, for the first time, of the FTAEIA on child mortality rate. We evaluate this effect at the country level for 1990-2019, the period in which the FTAEIA became a predominant trade policy instrument.

In contrast to expectations, we find that the entry into force, for the first time, of the FTAEIA has an adverse effect on mortality in children under five years of age. In the context in which all countries have been experiencing a drop in their mortality rates, although at a slower pace during the last decade, this result implies that the entry into force of the first FTAEIA leads to a slowdown in the drop of child mortality. Further, these results are robust even in a setting of multiple time periods and variation in treatment timing, which is successfully tested under the Callaway and Sant'Anna estimator and the event-study framework.

The rest of the paper is organized as follows. Section 2 presents the data used in the paper on trade openness and Regional Trade Agreements, and child mortality among other development indicators. Section 3 presents our empirical strategy to estimate the causal effect of the first FTAEIA's entry into force on child mortality. Section 4 presents our results and Section 5 presents the mechanisms through which FTAEIA affect child mortality. Finally, Section 6 concludes.

#### 2. Data

We use two kinds of data in this paper: (i) data on trade liberalization, and (ii) data on development indicators, mainly child mortality. The data on trade liberalization comes from two sources. The first one is the Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008) which includes all multilateral and bilateral regional trade agreements as notified to the World Trade Organization (WTO)<sup>4</sup> from 1950 to 2019. In total, the database includes information on 516 agreements for 280 countries that allow to identify the agreements, as well as the entry into force of agreements or enlargements. This database differentiates the agreements along seven categories, that according to the WTO are the agreement types or combinations that member countries of a Regional Trade Agreement (RTA) can notify. These categories are based on four types of agreements which are not mutually exclusive: Customs Union (CU), Free Trade

<sup>&</sup>lt;sup>4</sup> WTO's Regional Trade Agreements Gateway: <u>http://rtais.wto.org/UI/PublicMaintainRTAHome.aspx</u> and trade agreement websites when necessary details are not available.

Agreement (FTA), Partial Scope Agreement (PS), and Economic Integration Agreement (EIA)5. As there are agreements that involve goods and services at the same time, the remaining three categories are: Customs Union & Economic Integration Agreement (CUEIA), Free Trade & Economic Integration Agreement (FTAEIA), and Partial Scope & Economic Integration Agreement (PSAEIA). Most of the agreements are FTAs (287) and FTAEIA (163). Moreover, the database includes a variable that captures the combination of all of the former agreements which is classified as RTA.

Figure 1 presents the evolution of the seven categories of RTA over time and shows that FTAEIA became more predominant in the last two decades. In particular, growth in the use of FTAs has occurred even when average tariffs have been quite low (Average MFN Tariff across the world in 2017 was 8.9%). This reflects a trend towards deeper policy cooperation far beyond a reduction in applied tariffs including labor, environmental, human rights, among other aspects. Moreover, according to Limão (2016) trade agreements that cover deeper policy dimensions are increasingly important determinants of trade and account for a large and growing trade share of bilateral world trade.



Figure 1. Evolution of Regional Trade Agreements, 1960-2019

Source: Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008). Authors' own elaboration.

<sup>&</sup>lt;sup>5</sup> CU and FTA are defined as in Paragraph 8(a) and Paragraph 8(b) of Article XXIV of GATT 1994 accordingly. Moreover, PS is not defined or referred to in the WTO Agreement but covers only certain products and are notified under paragraph 4(a) of the Enabling Clause. Finally, FTAEIA is defined as in Article V of GATS.

In particular, of these agreements, the ones that have gained the most relevance are the Free Trade and Economic Integration Agreement (FTAEIA). This type of agreement, unlike the FTAs include deeper commercial provisions and are mainly focused on the area of services and the elimination of barriers in this sector. Likewise, these agreements range from those that seek deep integration such as the European Economic Area, NAFTA, MERCOSUR to those more recent (bilateral or plurilateral) that seek the liberalization of specific restrictions on trade in services such as the FTA between the United States and countries of Latin America. Appendix 1 shows the list of countries whose first FTAEIA entered into force in different periods, during 1990-2019. As it is observed, the first group of countries whose first FTAEIA entered into force, in 1994, includes mostly developed countries such as Belgium, Canada and the United States while developing countries are treated towards the end of the study period. For instance, Ecuador and Turkey were the countries whose first FTAEIA entered later, in 2017.

The second source is the data on openness and trade liberalization dates elaborated by Wacziarg and Welch (2008). This classification revises the approach of the dichotomous indicator of Sachs and Warner (1995) and extends it to 2008. According to the Sachs-Warner classification an economy is closed if it displays at least one of the following five criteria: (i) its average tariff rate exceeded 40%, (ii) its non-tariff barriers covered more than 40% of imports, (iii) it had a socialist economic system (iv) it had a state monopoly of major exports, or (v) its black-market premium on the exchange rate exceeded 20%. In this sense, Wacziarg and Welch attempt to maintain the same consistency of Sach-Warner but data availability imposes some restrictions and as a result some differences in the openness status raised<sup>6</sup>. Nevertheless, despite the attempt to correct some of the problems of the Sachs-Warner classification, the Wacziarg-Welch also relied on variables such as the black-market premium which captures macroeconomics distortions and export marketing board which acted as a proxy for being an African country. In fact, Rodriguez and Rodrik (1999) have documented that this and other indicators of trade openness such as those reported in Dollar (1992), Ben-David (1993), Edwards (1998) and Frankel and Romer (1999) present deep problems and are inappropriate measures of trade policy openness.

Figure 2 presents the evolution of the trade openness indicator according to Wacziarg-Welch/Sachs-Warner and the entry into force of the first FTA or FTAEIA. In 1990, on average a country was a member of 3 FTAs or FTAEIAs. In 2019, the same figure is 24. Following the wave of unilateral trade liberalizations in the 1980s and early 1990s and the lack of progress of multilateral liberalization efforts after the 1994 Uruguay round, countries around the world have

<sup>&</sup>lt;sup>6</sup> For instance, 46 countries that were classified as closed by Sachs-Warner in the 1970-1989 period are classified as open in the 1990s. Nevertheless, it is worth noting that no country that was classified as open by Sachs-Warner was classified as closed in the updated data.

turn their focus towards the negotiation and signature of bilateral, regional and in some cases large free trade agreements.



Figure 2. Evolution of trade openness indicators

Source: Wacziarg and Welch (2008), Mario Larch's Regional Trade Agreements Database from Egger and Larch (2008). Authors' own elaboration.

Further, the data on development indicators is obtained from the World Development Indicators (WDI) which is the World Bank's compilation of cross-country comparable data on development. It includes comparable statistics about global development indicators on health, agriculture, climate, labor, economics, poverty, trade, among others. The main indicator of the WDI database is the child mortality rate, i.e., under-five mortality rate per 1,000 live births, that is the probability per 1,000 live births that a newborn will die before reaching the age of five. This variable is an important indicator of health status in a country, is commonly used to identify the most vulnerable populations and so, is one of the most frequently used indicators to compare socioeconomic development between countries (World Bank, 2017).

As Figures 3 and 4 shows, child mortality rates have significantly decline in all world regions and income groups, and all the countries have benefitted from this progress. Only from 1990 to 2019, the under-five death rate fell from 93 to 38 deaths per 1,000 live births as child mortality has more than halved decreasing from 12.5 to 5.2 million. Nevertheless, although child mortality is at the lowest level it has ever been its reduction has slowed down and moreover, high disparities persist. For instance, in Sub-Saharan Africa there are still countries with child mortality rates greater than 10%, which means that one out ten children born die before reaching their fifth birthday.



Figure 3. Child mortality by region, 1990-2019

Source: World Bank. Authors' own elaboration.



Figure 4. Child mortality by income group, 1990-2019

Source: World Bank. Authors' own elaboration.

#### 3. Empirical strategy

Our goal in this paper is to estimate the causal effect of the entry into force, for the first time, of the FTAEIA on child mortality rate. Unlike existing studies that use the Frankel & Romer instrument (trade openness as % of GDP) or the Sachs-Warner/Wacziarg-Welch measure of liberalization (classification based on five indicators related to the level of tariffs, economic system, among other aspects), we focus on the most important dimension of trade reform in the

last 20 years. We evaluate this effect at the country level for 1990-2019, the period in which the FTAEIA became predominant.

The Staggered<sup>7</sup> Differences in Differences approach allows us to exploit the spatial and temporal variation of the entry into force of country's first FTAEIA as a source of exogenous variation. In particular, this approach allows us to compare the rate between those countries whose first FTAEIA entered into force and those that did not during 1990 and 2017, before and after the change in trade policy. The results are estimated according to the following specification:

$$Y_{ct} = \beta * FTAEIA_{ct} + f_c + f_t + \varepsilon_{ct}$$
(1)

In the regression above,  $Y_{ct}$  denotes the under-five mortality rate per 1,000 live births in country c at time t,  $FTAEIA_{ct}$  is a dummy variable that takes the value of 1 when country c first FTAEIA entries into force in year t and thereafter. The terms  $f_c$  and  $f_t$  represent country and year-level fixed effects, respectively. Standard errors are clustered at the country level allowing a serial correlation in the errors assuming that they are independent across countries.

The coefficient of interest  $\beta$  represents the estimated effect of the entry into force of the first FTAEIA on child mortality rates. The identification of this effect relies on the assumption of "parallel trends" whereby, in the absence of the treatment, the average outcomes for treated and comparison groups would have followed parallel paths over time. If this assumption holds, one can estimate the average treatment effect for the treated subpopulation (ATT) by comparing the average change in outcomes experienced by the treated group to the average change in outcomes experienced by the comparison group (Callaway and Sant'Anna 2021).

Nevertheless, there are several recent methodological papers that suggest that, under multiple time periods and variation in treatment timing, the Two Way Fixed Effect DiD estimator could be biased. This literature claims that under this setting, the coefficient of interest is not easily interpretable and is not consistent for the Average Treatment Effect (ATE) or Average Treatment Effect on the Treated (ATT), and also can yield estimates with the opposite sign compared to the true ATE or ATT (Baker, Larcker, and Wang 2021). Goodman-Bacon (2021) has derived an expression for the estimator obtained from the staggered Differences-in-Differences design when there are more than two time periods and treatment units receive the intervention at different points in time. He finds that the linear estimator is a weighted average of all possible estimators for every two units and two time periods, known as "2x2" DiD estimates, with potentially negative weights which can yield estimates with the wrong sign. In this sense, Goodman-Bacon also proposes a diagnostic test for identifying the potential bias by each constituent comparison's

<sup>&</sup>lt;sup>7</sup> Staggered Difference in Difference refers to setups such that once units are treated, they remain treated in the following period. This assumption is also called "Irreversibility of Treatment".

implicit assigned weight (which is a function of treatment timing and group size) and constituent comparison's type (e.g., earlier vs. later treated states or later vs. earlier treated states). As expected, the potential for bias is greater if the estimate involves comparisons of later-treated units to early-treated ones (as control group) (Goodman-Bacon 2021).

In response, we use the Callaway and Sant'Anna (2018) estimator to deal with the bias inherent in this design and ensure that the estimation process is not contaminated by comparisons between later-treated countries versus earlier-treated countries. As other estimators, Callaway and Sant'Anna compare the treated countries to a clean set of control countries and rely on an event study design that allows the inclusion of leads and lags of the treatment variable instead of a single indicator variable. The later takes the following form:

$$Y_{ct} = \sum_{k} \beta_k \,\mathbb{I}\{t - E_i = k\} + f_c + f_t + \varepsilon_{ct} \tag{2}$$

Where  $E_i$  is the time period when treatment begins for country c and  $\mathbb{I}\{t - E_i = k\}$  is an indicator for being k years from the treatment starting. As pointed out but this recent literature, one of the most important advantages of this setting is that it allows us to break down the average difference captured in  $\beta$  into the differences between treated and comparison units at each time period relative to the treatment adoption. Due to the staggered adoption, this helps to resolve some of the variance-weighted averaging concerns and indeed, contributes to the evaluation of the credibility of the parallel trend assumption.

Further, Callaway and Sant'Anna define the ATT for a timing group g at a point-in-time t, which is called the "group-time average treatment effect". In particular, a group g is defined by when countries are first treated (i.e., FTAEIA entered, for the first time, into force) an time period t:

$$ATT_g(t) \equiv \mathbb{E}(Y_{i,t}(1) - Y_{i,t}(0) | g)$$
(3)

In this sense, the  $ATT_g(t)$  is the expected difference between the observed outcome variable for treated countries at time t and the outcome if the countries had not received the intervention. More important, this formulation allows for heterogeneity in the ATT across treatment groups or over time. Moreover, Callaway and Sant'Anna propose different methods for aggregating the group-time average treatment effects. Intuitively, the overall effect is a weighted average of the  $ATT_g(t)$  taking observations from the control group (that could be either never-treated or not-yet treated by period t) and group g, omitting other groups<sup>8</sup>. Finally, the Callaway and Sant'Anna estimator also allows for the estimation of aggregate treatment effects by either relative time (i.e., the event study approach) or by calendar time. Moreover, it allows to report the estimates with balanced

<sup>&</sup>lt;sup>8</sup> Specifically, then up-weight observations from the control group that have characteristics similar to those frequently found in group g and down-weight observations from the control group that are rarely in group g.

groups and relaxing the non-anticipation assumption. For further information, see Callaway and Sant'Anna 2021; Roth et al. 2022; and Baker, Larcker, and Wang 2021.

#### 4. Results

Table 1 shows the results under specification of equation (1) for three measures of trade openness. Column 1 shows that consistently with previous research, there is a statistically significant and negative impact under the Wacziarg-Welch/Sachs-Warner measure. Moreover, column 2 shows that FTA has not statistically impact on child mortality while contrary to the expectations, the entry into force, for the first time, of the FTAEIA has a significant and positive impact on child mortality rates (column 3).

| Variable              | (1)        | (2)     | (3)       |
|-----------------------|------------|---------|-----------|
|                       |            |         |           |
| Wacziarg-Welch (2008) | -24.443*** |         |           |
|                       | (5.955)    |         |           |
| Any FTA               |            | 3.452   |           |
| 5                     |            | (3.357) |           |
| FTAEIA                |            | ( )     | 18.051*** |
|                       |            |         | (2.769)   |
|                       |            |         |           |
| Observations          | 5,610      | 5,610   | 5,610     |
| R-squared             | 0.465      | 0.443   | 0.488     |
| # Countries           | 187        | 187     | 187       |
| Covariates            | No         | No      | No        |
| Country and year FE   | Yes        | Yes     | Yes       |

Table 1. Main results of trade openness and Trade Agreements on child mortality

Robust standard errors in parentheses

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

Further, we performed the decomposition of Goodman-Bacon (2019) for testing the potential bias of the linear estimator as countries' first FTAEIAs entry into force in different time periods. The decomposition is performed for the specification of column 3 of Table 1 that controls only for country and year fixed effects<sup>9</sup>. The results shown in Table 2 and Figure 5 show that about 70% of the total effect significant at 1% comes from the right comparison between countries that signed the Agreement ("Treated") and those countries that never signed an FTAEIA ("Never Treated"). Nevertheless, it is important to notice that despite all the weights of the "2x2" estimator are positive, 18% of its magnitude comes from comparisons of later-treated countries (as treatment

<sup>&</sup>lt;sup>9</sup> The Goodman-Bacon decomposition can only be used with balanced panels and do not incorporate covariates. But, as Baker et al., (2021) has pointed out researchers should always analyze covariate-free variants of DiD analysis as starting points.

group) to early-treated countries (as control group). In this sense, the bias could potentially affect the robustness of the estimated coefficient.

| Table 2. Goodman-Bacon decomposition       |        |                       |  |  |
|--|--------|-----------------------|--|--|
| Comparison                                 | Weight | Estimated coefficient |  |  |
| Earlier Treated vs. Later Group Comparison | 0.127  | 5.285                 |  |  |
| Later Treated vs. Earlier Group Comparison | 0.177  | -6.162                |  |  |
| Treated vs. Never Treated                  | 0.696  | 26.525                |  |  |
| FTAEIA= 1                                  |        | 18.051***             |  |  |

Note: \*\*\* p < 0.01, \*\* p < 0.05, \* p < 0.10. The graph shows the estimated parameter for the years before and after the change in the FTAEIA of a regression that controls for fixed effects at the country and year level. Standard errors they are clustered at the country level. The comparison groups correspond to those groups defined in Goodman-Bacon (2019).

Additionally, the Figure 5 shows that all the Treated vs Never Treated comparison yield positive estimated treatment effects (i.e., all the triangular blue points lie above zero), while several of the Later vs Earlier Treated Comparisons and Earlier vs Later Treated Comparisons yield negative estimated treatment effects.



Figure 5. Goodman-Bacon graphical decomposition of the estimator

Note: The graph shows the estimated parameter for the years before and after the change in the FTAEIA of a regression that controls for fixed effects at the country and year level. The standard errors are clustered at the country level. The comparison groups correspond to those defined in Goodman-Bacon (2019).

Further, we also present the results for the Callaway and Sant'Anna estimator replicating the results in Table 1 without conditioning on covariates and using both never treated and not yet treated countries as control groups. As estimates show, the effect of FTAEIA is also statistically significant and positive which reinforces the validity and the robustness of the causal estimates shown in the Table 2.

| Variable              | ATT        | Std. Error | [95% C   | onf. Int.] |
|-----------------------|------------|------------|----------|------------|
| Wacziarg-Welch (2008) | -8.6735    | 5.5045     | -19.4621 | 2.115      |
| Any FTA               | 17.3305*** | 4.0879     | 9.3184   | 25.3426    |
| FTAEIA                | 27.3189*** | 2.7511     | 21.9268  | 32.711     |

Table 3. Callaway and Sant'Anna estimator

Note: \*\*\* p <0.01, \*\* p <0.05, \* p <0.10.

Moreover, Appendix 2 shows the decomposition of the Callaway and Sant'Anna estimates for FTAEIA, allowing for treatment effect heterogeneity and dynamics. As can be observed for the Group-Time Average Treatment Effects, there is strong evidence of positive effects of FTAEIA on child mortality as for most of the groups the estimates on the post-treatment periods are positive and statistically different from cero.

As pointed out by the authors, the estimates in Appendix 2 facilitate the observation of heterogeneous effects across groups and time but some of the costs are that it can be hard to summarize them. Therefore, we also present the results after aggregating Group-Time Average Treatment Effects. Table 3 shows that the overall ATT is statistically significant at 1% and positive and so, the results are similar to the previous ones under the Staggered DiD approach. Specifically, the overall impact amounts to 27.3 percentual points per 1,000 live births.

#### Table 3. Overall summary of ATT's based on event-study/dynamic aggregation

ATT Std. Error [ 95% Conf. Int.] 27.3189 2.7511 21.9268 32.711 \*

| Dynamic Effe | ects:    |            |              |             |
|--------------|----------|------------|--------------|-------------|
| Event time   | Estimate | Std. Error | [95% Simult. | Conf. Band] |
| -26          | -1.9114  | 0.6570     | -3.7709      | -0.0518 *   |
| -25          | -0.2402  | 0.6520     | -2.0857      | 1.6052      |
| -24          | -0.1026  | 0.6917     | -2.0603      | 1.8551      |
| -23          | -0.2152  | 0.7184     | -2.2486      | 1.8182      |
| -22          | -0.1180  | 0.5441     | -1.6580      | 1.4219      |
| -21          | -0.0805  | 0.3870     | -1.1759      | 1.0149      |
| -20          | 0.1028   | 0.4027     | -1.0371      | 1.2426      |
| -19          | -0.2617  | 0.4608     | -1.5661      | 1.0427      |
| -18          | -0.1523  | 0.3745     | -1.2123      | 0.9077      |
| -17          | 0.3385   | 0.2638     | -0.4082      | 1.0853      |
| -16          | -0.0077  | 0.2585     | -0.7392      | 0.7239      |
| -15          | 0.0927   | 0.2684     | -0.6669      | 0.8522      |
| -14          | 0.1410   | 0.3180     | -0.7590      | 1.0409      |
| -13          | 0.4983   | 0.2375     | -0.1740      | 1.1707      |
| -12          | 0.7864   | 0.2355     | 0.1199       | 1.4529 *    |
| -11          | 0.8144   | 0.2093     | 0.2219       | 1.4068 *    |
| -10          | 0.6897   | 0.2119     | 0.0898       | 1.2896 *    |
| -9           | 0.8559   | 0.1925     | 0.3111       | 1.4007 *    |
| -8           | 1.0658   | 0.2240     | 0.4316       | 1.6999 *    |
| -7           | 0.9701   | 0.2147     | 0.3625       | 1.5777 *    |
| -6           | 1.0403   | 0.2663     | 0.2867       | 1.7940 *    |

| -5<br>-4 | 1.3360<br>1.2340 | 0.2811<br>0.2174 | 0.5402<br>0.6186 | 2.1317 *<br>1.8493 * |
|----------|------------------|------------------|------------------|----------------------|
| -3       | 1.4685           | 0.2667           | 0.7136           | 2.2234 *             |
| -2       | 1.1028           | 0.2970           | 0.2621           | 1.9435 *             |
| -1       | 1.1954           | 0.1879           | 0.6637           | 1.7272 *             |
| 0        | 1.2582           | 0.1869           | 0.7292           | 1.7872 *             |
| 1        | 2.8623           | 0.4106           | 1.7001           | 4.0245 *             |
| 2        | 4.0375           | 0.5359           | 2.5206           | 5.5545 *             |
| 3        | 5.6396           | 0.6916           | 3.6822           | 7.5971 *             |
| 4        | 7.4488           | 0.9114           | 4.8692           | 10.0284 *            |
| 5        | 9.3282           | 1.0984           | 6.2194           | 12.4371 *            |
| 6        | 11.0439          | 1.2629           | 7.4692           | 14.618/ *            |
|          | 13.185/          | 1.5480           | 8.8040           | 17.56/4 *            |
| ð        | 15.1448          | 1.0510           | 10.4699          | 19.8197 *            |
| 10       | 10.9468          | 1.7920           | 11.8/40          | 22.0189 *            |
| 10       | 19.0018          | 2.2124           | 12.7390          | 23.2041 *            |
| 12       | 20.0430          | 2.4140           | 14.0152          | 27.0703 *            |
| 12       | 23.01/2          | 2.0912           | 10 2057          | 25 1616 *            |
| 1/       | 20 0606          | 2.0734           | 20 /215          | 30 5177 *            |
| 15       | 32 6667          | 3 1780           | 20.4213          | 12 5135 *            |
| 16       | 34 5383          | 3 5981           | 24 3539          | 44 7227 *            |
| 17       | 38 8145          | 3 8049           | 28.0449          | 49 5841 *            |
| 18       | 40 9202          | 3 9700           | 29 6832          | 52 1572 *            |
| 19       | 45.0399          | 4,5036           | 32,2927          | 57.7872 *            |
| 20       | 46.5053          | 4.6065           | 33.4667          | 59.5439 *            |
| 21       | 48.4770          | 4.8566           | 34.7304          | 62.2235 *            |
| 22       | 51.5985          | 5.0619           | 37.2708          | 65.9261 *            |
| 23       | 53.1832          | 4.9289           | 39.2319          | 67.1344 *            |
| 24       | 54.5441          | 5.2384           | 39.7168          | 69.3714 *            |
| 25       | 57.2442          | 5.0818           | 42.8603          | 71.6282 *            |

Signif. codes: `\*' confidence band does not cover 0

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Control Group: Not Yet Treated, Anticipation Periods: 0 Estimation Method: Outcome Regression

Moreover, Figure 6 shows graphically that in general, one fails to reject the parallel trends assumption in most of the pre-treatment periods. In those pre-treatment periods in which parallel trend assumption is rejected, the effects are particularly small. Further, the aggregated effects in the post-treatment periods are statistically significant and positive and are continuously increasing.





Authors' own elaboration.

In the dynamic effect estimators showed in Table 3 and Figure 6, the composition of the groups changes with different lengths of exposure in the event study plots. For instance, those countries such as Belgium, Canada, the United States and other developed countries whose first FTAEIA entered into force in 1994 are exposed for 25 years to the treatment and so, we can identify the average effect along the 25 post-treatment periods shown in the Figure 6. Nevertheless, for Ecuador and Turkey -the countries whose first FTAEIA entered into force in 2017- we can only identify the average effect on event-times e=0,1,2. In particular, if the effects on child mortality are systematically different across groups (which is plausible given the composition of groups presented in Appendix 1) then those estimates can lead to confounding dynamics and selective treatment timing among different groups. For this reason, we balance the sample including groups that exposed to the treatment for at least six time periods and only look at dynamic effects in those time periods, i.e., dropping groups that are not exposed for at least seven periods. Appendix 3 shows the ATT's based on the event-study aggregation for this scenario while Appendix 4 displays its respective event-study plot.

One of the main advantages of the Callaway and Sant'Anna estimator is that it allows the decomposition of group-specific effects and calendar-time effects. Results are shown in Appendix 5-8 display these effects. In Appendix 6, the y-axis is categorized by group while the x-axis provides the estimates of the average effect by group. As can be observed, the average effect is largest for group 5 (countries whose FTAEIA entered into force, for the first time, in 1994) which is explained the effect of treatment increases with length of exposure and this group is exposed to the treatment for the longest, specifically for 25 years. Despite we do not find significant effects for groups 14, 16 and 18 it is worth noting that none of the effects are negative. Moreover, Appendix 8 shows the calendar time effects, where the x-axis is the time period and the y-axis displays the average effect of participation in the treatment in a particular time period for all groups that participated in the treatment in the corresponding period.

Similarly, Table 4 shows the results for various measures of under-five mortality. Consistently with previous results, we find a positive and significant effect on neonatal and infant mortality. Both effects are of lesser magnitude regarding the effect on mortality in childhood which would show that there are transmission mechanisms transversal to the age group between one and five years of age that would explain the direction of the estimated effect. In this line, it should be noted that precisely in the last three decades, the age group that recorded the greatest reduction in mortality was children between one and four years of age, followed by children under one year of age, neonates and newborns under one week. Regarding to this, the WHO notes that the greatest progress in "older" children, who often die from diarrhea, pneumonia, measles, and meningitis, would come from advances in immunization for those immune-preventable diseases that cannot be

prevented (World Bank, 2018). Further, these results are hold by gender with a slightly higher effect for boys than for girls.

| Variables              | Neonatal  | Infant    | Child mortality |           |
|------------------------|-----------|-----------|-----------------|-----------|
| variables              | mortality | mortality | Female          | Male      |
|                        |           |           |                 |           |
| FTAEIA – Staggered DiD | 2.215***  | 8.866***  | 17.688***       | 18.408*** |
|                        | (0.627)   | (1.561)   | (2.706)         | (2.835)   |
| FTAEIA – Callaway and  | 4.3734*** | 14.639*** | 26.628***       | 27.971*** |
| Sant'Anna              | (0.568)   | (1.561)   | (2.718)         | (2.831)   |
| Observations           | 5,610     | 5,610     | 5,610           | 5,610     |
| Number of countries    | 187       | 187       | 187             | 187       |
| Covariates             | No        | No        | No              | No        |
| Country and year FE    | Yes       | Yes       | Yes             | Yes       |

| Table 4. | FTAEIA | by a | age   | group | and | gender |
|----------|--------|------|-------|-------|-----|--------|
|          |        | ~    | · · · | 5-0-0 |     | 5      |

Robust standard errors in parentheses

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

Callaway and Sant'Anna estimator uses never treated and not-yet treated countries as a control group.

Likewise, Figure 7 shows the results of the event studies for the Callaway and Sant'Anna estimates in Table 4. As can be observed, one fails to reject the parallel trends assumption in all the pre-treatment periods and the aggregated effects in the post-treatment periods are statistically significant and positive and are continuously increasing.

Figure 7. Event study plot for the Aggregating Group-Time Average Treatment Effects of Callaway and Sant'Anna estimator, by age group and gender



Finally, the impact of the entry into force, for the first time, of a FTAEIA on child mortality could vary depending on the income level of the trading partner. For this reason, we also estimate some heterogeneities that aim to characterize the overall effect. Table 5 shows that the impact of FTAEIA on child mortality remains statistically significant and positive for both developed and developing trading partners, but the impact is greater for developed countries than for developing ones. Likewise, the entry into force, for the first time, of a FTAEIA has a statistically significant and positive effect whether the trading parent was the United States, countries from the European Union or Japan. Despite the magnitude for the European Union members is smaller than for the United Stated and even more for Japan, the direction of the effect validates the positive impact of the entry into force of FTAEIA on child mortality rates and its causal interpretation (see Appendix 9-11)<sup>10</sup>.

| Variables           | (1)         | (2)       | (3)      | (4)       |
|---------------------|-------------|-----------|----------|-----------|
| Developed           | 15 170***   |           |          |           |
| Developed           | $(2 \ 471)$ |           |          |           |
| Developing          | 12 409***   |           |          |           |
| Developing          | (2.381)     |           |          |           |
| FTAEIA with USA     | ()          | 10.956*** |          |           |
|                     |             | (3.018)   |          |           |
| FTAEIA with EU      |             | ~ /       | 8.312*** |           |
|                     |             |           | (1.853)  |           |
| FTAEIA with Japan   |             |           |          | 13.931*** |
|                     |             |           |          | (3.533)   |
| Observations        | 5,610       | 5,610     | 5,610    | 5,610     |
| R-squared           | 0.503       | 0.446     | 0.451    | 0.449     |
| Number of countries | 187         | 187       | 187      | 187       |
| Covariates          | No          | No        | No       | No        |
| Country and year FE | Yes         | Yes       | Yes      | Yes       |

#### Table 5. FTAEIA characteristics

Robust standard errors in parentheses

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

#### 5. Mechanisms

This section explores the mechanisms whereby the entry into force, for the first time, of the FTAEIA has an adverse effect on child mortality rates. For this purpose, we evaluate the impact of the entry into force of these agreement on several variables associated with the main causes of child mortality, as identified by the World Health Organization (WHO) and the World Bank.

<sup>&</sup>lt;sup>10</sup> Event studies for the impacts on FTAEIA with USA, EU and Japon are displayed in Appendix 9-11. As expected, one fails to reject the parallel trend assumption which validates the causal interpretation of the impact.

Table 6 shows that the entry into force, for the first time, of FTA would decrease immunization, both DPT and measles. This is important as the World Bank and the WHO highlight immunization as the key to reducing deaths in children from infectious diseases, one of the leading causes of childhood mortality. In fact, according to WHO, measles immunization also reduces the risk of childhood pneumonia, and it would have prevented nearly 21 million deaths in Africa. Similarly, we find a significant and positive effect on anemia among children which according to the World Bank is one of the external factors associated with the rate of premature deaths since it is linked to access to nutritious food and adequate supplementation. Finally, we do not find any significant effect on under-nourishment and on neither of the methane emission measures. This is important as, for instance, according to the World Bank, air pollution, especially indoors, has decreased due to access to cleaner fuels but remains as one of the risk factors related to pneumonia and other respiratory diseases, especially in those countries where the proportion of households with access to clean cooking fuels is very low (World Bank, 2018).

|                       | Immun     | ization   | Anemia            | Under-      | Methane     | emissions   |
|-----------------------|-----------|-----------|-------------------|-------------|-------------|-------------|
| Variables             | DPT       | Measles   | among<br>children | nourishment | All         | Energy      |
|                       |           |           |                   |             |             |             |
| FTAEIA –              | -3.889*** | -2.318**  | 2.104***          | -0.783      | 3,102.411   | 2,885.818   |
| Staggered DiD         | (1.177)   | (1.068)   | (0.548)           | (0.673)     | (6,362.364) | (3,691.916) |
| FTAEIA – Callaway and | -3.6708** | -3.8776** | 2.4318***         | 0.7293      | -1086.346   | -1048.039   |
| Sant'Anna             | (1.4101)  | (1.319)   | (0.5615)          | (0.8033)    | (3,347.153) | (1,581.933) |
| Observations          | 5.485     | 5.477     | 4.887             | 2.628       | 4,169       | 3.553       |
| Number of countries   | 187       | 187       | 181               | 146         | 183         | 187         |
| Covariates            | No        | No        | No                | No          | No          | No          |
| Country and year FE   | Yes       | Yes       | Yes               | Yes         | Yes         | Yes         |

 Table 6. Transmission mechanisms of the FTAEIA on child mortality

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

Finally, we also analyze if the adverse impact of FTAEIA on child mortality could be explained by a deterioration of childcare and feeding, as a result of an increase in female labor force participation. As the World Bank points out this could affect child health through less time allocated for breastfeeding -one of the most effective interventions to prevent pneumonia- and less access to immunization (World Bank, 2018). Table 7 shows the results. We find a statistically significant and positive effect on total female labor force participation and female labor force participation in the agriculture sector. As we also find a statistically significant and negative effect on labor force participation on industry, we could argue that the entry into force of FTAEIA effectively lead to an increase in female labor force participation, mainly in the agriculture sector.

| <b>V</b> <sub>2</sub> ,, .1.1, | Fema        | le employme | ent      | Female labor        | Female       |
|--------------------------------|-------------|-------------|----------|---------------------|--------------|
| variables                      | Agriculture | Industry    | Services | force participation | unemployment |
|                                |             |             |          |                     |              |
| FTAEIA – Staggered DiD         | 1.645**     | -1.030*     | -0.616   | 1.159*              | -0.506       |
|                                | (0.805)     | (0.558)     | (0.688)  | (0.595)             | (0.418)      |
| FTAEIA – Callaway and          | 2.7902**    | -2.1835**   | -0.6069  | 2.7879*             | -0.3488      |
| Sant'Anna                      | (0.6947)    | (0.544)     | (0.6263) | (0.6504)            | (0.4664)     |
| Observations                   | 5,046       | 5,046       | 5,046    | 5,220               | 5,046        |
| Number of countries            | 174         | 174         | 174      | 174                 | 174          |
| Covariates                     | No          | No          | No       | No                  | No           |
| Country and year FE            | Yes         | Yes         | Yes      | Yes                 | Yes          |

Table 7. Transmission mechanisms of the FTAEIA on child mortality

Robust standard errors in parentheses

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

#### 6. Conclusions

In this paper we estimate the causal impact of the entry into force, for the first time, of a FTAEIA on child mortality rates. We show that in contrast to expectations, the entry into force of these agreements has had a significant and positive effect on the probability of death in children under five years of age per 1,000 live births between 1990-2019. As child mortality has significantly decreased in all regions of the world, regardless of geographic location and income level, although at a slower pace in the last decade, this result implies that the entry into force of the first FTAEIA leads to a slowdown in the drop of child mortality. The results show that the direction of the estimated effect is maintained for children under five years of age and, in smaller measure, for neonatal mortality and child mortality, and also that this result holds regardless of gender. Among the transmission mechanisms we find evidence that supports that female labor force participation increased as a result of the entry into force of FTAEIA. As this is associated with a deterioration of childcare and feeding, we find the decrease of immunization and increase of anemia consistent with this via. We provide strong evidence that supports this causal interpretation under a setting of multiple time periods and variation in treatment timing by implementing the Callaway and Sant'Anna estimator. Moreover, the validity of the event studies allows us to verify that the parallel trend assumption unconditionally holds.

Finally, these results have important implications for the literature on trade liberalization and, for the design of public policies. We provide evidence of adverse effects of FTAEIA -one of the most important dimensions of trade policy reform over the last 20 years- on one of the most relevant indicators of development across countries. In this sense, this research aims to contribute to the implementation of measures to mitigate or compensate for losses and ensure that benefits of trade integration are broadly distributed. This is particularly important amidst the discussions of trade policy reforms and trade integration in the world in which protectionist policies reflect concerns about the redistribution of the benefits of past trade reforms.

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# APPENDIX

| r   |   |  |  |   |
|---|---|--|--|---|
|   | Afghanistan   | Egypt, Arab Rep  | Malawi   | Somalia   |
|   | Algeria   | Equatorial Guinea  | Maldives   | South Africa  |
|   | Andorra   | Eritrea  | Mali   | South Sudan   |
|   | Angola  | Eswatini   | Mauritania   | Sri Lanka   |
|   | Argentina   | Ethiopia   | Mauritius  | Sudan   |
|   | Bangladesh  | Fiji   | Micronesia, Fed Sts  | Syrian Arab Republic  |
|   | Benin   | Gabon  | Monaco   | Tajikistan  |
|   | Bhutan  | Gambia, The  | Mozambique   | Tanzania  |
|   | Bolivia   | Ghana  | Namibia  | Timor-Leste   |
|   | Botswana  | Guinea   | Nauru  | Togo  |
|   | Brazil  | Guinea-Bissau  | Nepal  | Tonga   |
| Never treated   | Burkina Faso  | Haiti  | Niger  | Tunisia   |
|   | Burundi   | Iran, Islamic Rep  | Nigeria  | Turkmenistan  |
|   | Cabo Verde  | Iraq   | Palau  | Tuvalu  |
|   | Cameroon  | Israel   | Papua New Guinea   | Uganda  |
|   | Central African Republic  | Kenya  | Paraguay   | Uzbekistan  |
|   | Chad  | Kiribati   | Rwanda   | Vanuatu   |
|   | Comoros   | Korea. Dem People's Rep  | Samoa  | Venezuela, RB   |
|   | Congo, Dem Rep  | Lebanon  | San Marino   | Yemen, Rep  |
|   | Congo, Ren  | Lesotho  | Sao Tome and Principe  | Zambia  |
|   | Cote d'Ivoire   | Liberia  | Senegal  | Zimbabwe  |
|   | Cuba  | Libva  | Sevehelles   | Zimbaowe  |
|   | Diibouti  | Madagascar   | Sierra Leone   |   |
|   | Belgium   | Greece   | Luxembourg   | Portugal  |
|   | Canada  | Hungary  | Mexico   | Spain   |
| Crown 4-1004  | Danmanlı  | Tungary  | Netherlands  | Spann<br>United Vinedom   |
| Group 4–1994  | Eren aa   | Iteland  | Deland   | United Kingdom  |
|   | France  | Italy  | Poland   | United States   |
|   | Germany   |  |  |   |
|   | Arretuin  | Cente Dies   | E1   | D   |
| C ( 1005  | Austria   | Costa Rica   | Finland  | Romania   |
| Group 6=1995  | Austria<br>Bulgaria   | Costa Rica<br>Czech Republic   | Finland<br>Latvia  | Romania<br>Slovak Republic  |
| Group 6=1995  | Austria<br>Bulgaria<br>Colombia   | Costa Rica<br>Czech Republic<br>Estonia  | Finland<br>Latvia<br>Lithuania   | Romania<br>Slovak Republic<br>Sweden  |
| Group 6=1995<br>Group 8=1997  | Austria<br>Bulgaria<br>Colombia<br>Chile  | Costa Rica<br>Czech Republic<br>Estonia  | Finland<br>Latvia<br>Lithuania   | Romania<br>Slovak Republic<br>Sweden  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua   | Costa Rica<br>Czech Republic<br>Estonia  | Finland<br>Latvia<br>Lithuania   | Romania<br>Slovak Republic<br>Sweden  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic   | Costa Rica<br>Czech Republic<br>Estonia  | Finland<br>Latvia<br>Lithuania<br>Jordan   | Romania<br>Slovak Republic<br>Sweden  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador  | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan  | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan  | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia  | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine   |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine   |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta  | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 16=2005   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia  | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India  | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Thailand   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay  |
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| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 16=2005<br>Group 17=2006  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia<br>Bahrain<br>Cambodia   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India<br>Brunei Darussalam<br>Lao PDR  | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Thailand<br>Malasya<br>Philippines   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay<br>Morocco<br>Vietnam  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 16=2005<br>Group 17=2006<br>Group 18=2007   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia<br>Bahrain<br>Cambodia<br>Indonesia  | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India<br>Brunei Darussalam<br>Lao PDR<br>Mvanmar   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Thailand<br>Malasya<br>Philippines   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay<br>Morocco<br>Vietnam  |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 16=2005<br>Group 17=2006<br>Group 18=2007   | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia<br>Bahrain<br>Cambodia<br>Indonesia<br>Antigua and Barbuda   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India<br>Brunei Darussalam<br>Lao PDR<br>Myanmar<br>Dominica   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Thailand<br>Malasya<br>Philippines<br>Pakistan   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay<br>Morocco<br>Vietnam  |
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| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 16=2005<br>Group 17=2006<br>Group 18=2007<br>Group 19=2008  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia<br>Bahrain<br>Cambodia<br>Indonesia<br>Antigua and Barbuda<br>Bahamas, The<br>Barbados   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India<br>Brunei Darussalam<br>Lao PDR<br>Myanmar<br>Dominica<br>Grenada<br>Guyana  | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Thailand<br>Malasya<br>Philippines<br>Pakistan<br>St Kitts and Nevis<br>St Lucia   | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay<br>Morocco<br>Vietnam<br>Suriname<br>Trinidad and Tobago           |
| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 16=2005<br>Group 17=2006<br>Group 18=2007<br>Group 19=2008  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia<br>Bahrain<br>Cambodia<br>Indonesia<br>Antigua and Barbuda<br>Bahamas, The<br>Barbados<br>Belize   | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India<br>Brunei Darussalam<br>Lao PDR<br>Myanmar<br>Dominica<br>Grenada<br>Guyana<br>Jamaica   | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Thailand<br>Malasya<br>Philippines<br>Pakistan<br>St Kitts and Nevis<br>St Lucia<br>St Lucia<br>St Uincent and the Gren  | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay<br>Morocco<br>Vietnam<br>Suriname<br>Trinidad and Tobago<br>adines |
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| Group 6=1995<br>Group 8=1997<br>Group 9=1998<br>Group 12=2001<br>Group 13=2002<br>Group 14=2003<br>Group 15=2004<br>Group 15=2004<br>Group 16=2005<br>Group 17=2006<br>Group 19=2008<br>Group 19=2008<br>Group 20=2009<br>Group 21=2010<br>Group 24=2013                  | Austria<br>Bulgaria<br>Colombia<br>Chile<br>Nicaragua<br>Dominican Republic<br>El Salvador<br>Guatemala<br>Japan<br>Azerbaijan<br>China<br>Cyprus<br>Korea, Rep<br>Croatia<br>Bahrain<br>Cambodia<br>Indonesia<br>Antigua and Barbuda<br>Bahamas, The<br>Barbados<br>Belize<br>Albania<br>Montenegro<br>Kuwait          | Costa Rica<br>Czech Republic<br>Estonia<br>Honduras<br>Iceland<br>Georgia<br>Moldova<br>Malta<br>North Macedonia<br>India<br>Brunei Darussalam<br>Lao PDR<br>Myanmar<br>Dominica<br>Grenada<br>Guyana<br>Jamaica<br>Oman<br>Saudi Arabia                         | Finland<br>Latvia<br>Lithuania<br>Jordan<br>Norway<br>Panama<br>Slovenia<br>Slovenia<br>Thailand<br>Malasya<br>Philippines<br>Pakistan<br>St Kitts and Nevis<br>St Lucia<br>St Lucia<br>St Vincent and the Grent<br>Peru<br>United Arab Emirates | Romania<br>Slovak Republic<br>Sweden<br>Singapore<br>Switzerland<br>Ukraine<br>Uruguay<br>Morocco<br>Vietnam<br>Suriname<br>Trinidad and Tobago<br>adines |
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# Appendix 1. Distribution of countries by treatment group

# Appendix 2. Group-Time Average Treatment Effects:

| Group_Time_ATT(g,t)_Std.                              | Error [95%       | simult. Conf       | . Band]                |
|---|------------------|--------------------|------------------------|
| 5 2 1.0259<br>5 3 0.8871                              | 0.1915           | 0.4329             | 1.6188 *               |
| 5 4 0.7594  | 0.2107           | 0.1072             | 1.4116 *               |
| 5 5 0.3876<br>5 6 1 7176                              | 0.8228           | -2.1597            | 2.9350                 |
| 5 7 3.3844  | 0.6014           | 1.5223             | 5.2465 *               |
| 5 8 4.6971  | 0.8119           | 2.1835             | 7.2108 *               |
| 5 9 6.1613<br>5 10 8 3210                             | 1.0558<br>1.1239 | 2.8925<br>4.8413   | 9.4300 *               |
| 5 11 10.4536  | 1.3347           | 6.3212             | 14.5860 *              |
| 5 12 13.0715  | 1.5403           | 8.3027             | 17.8403 *              |
| 5 13 13.3141<br>5 14 18.0304                          | 1.9600           | 11.9622            | 24.0985 *              |
| 5 15 20.8540  | 2.3165           | 13.6822            | 28.0258 *              |
| 5 16 23.4434<br>5 17 26.1915                          | 2.5701           | 17.5658            | 31.4005 *<br>34.8172 * |
| 5 18 28.1264  | 3.0411           | 18.7112            | 37.5416 *              |
| 5 19 33.6857<br>5 20 36 3479                          | 3.4101           | 23.1280            | 44.2433 *<br>47 6098 * |
| 5 21 37.7595  | 3.9489           | 25.5335            | 49.9854 *              |
| 5 22 41.0699  | 4.0005           | 28.6843            | 53.4556 *              |
| 5 24 46.6499  | 4.2852           | 33.3827            | 59.9172 *              |
| 5 25 48.2255  | 4.3598           | 34.7273            | 61.7236 *              |
| 5 26 49.7357<br>5 27 52.6421                          | 4.4669           | 35.9061<br>37.7487 | 63.5653 *<br>67.5355 * |
| 5 28 54.4619  | 4.9461           | 39.1485            | 69.7753 *              |
| 5 29 55.8835  | 4.9373           | 40.5976            | 71.1694 *              |
| 6 2 1.3721  | 0.3297           | 0.3515             | 2.3928 *               |
| 6 3 1.3007  | 0.2924           | 0.3955             | 2.2059 *               |
| 6 5 0.4266  | 0.2385           | -2.3308            | 3.1839                 |
| 6 6 1.1901  | 0.2843           | 0.3099             | 2.0703 *               |
| 6 / 2./358<br>6 8 3 9179                              | 0.7525           | 0.4060             | 5.0656 *               |
| 6 9 5.1538  | 0.8560           | 2.5036             | 7.8041 *               |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 1.1111<br>1 3345 | 3.5361             | 10.4164 *<br>12 9758 * |
| 6 12 11.3058  | 1.6200           | 6.2901             | 16.3214 *              |
| 6 13 13.6320  | 1.8109           | 8.0252             | 19.2387 *              |
| 6 15 18.6884  | 2.1304           | 11.1294            | 26.2475 *              |
| 6 16 21.0850  | 2.6503           | 12.8795            | 29.2905 *              |
| 6 17 23.5802<br>6 18 25 3556                          | 2.9403           | 14.4770            | 32.6833 *<br>35 4295 * |
| 6 19 30.6822  | 3.8085           | 18.8908            | 42.4735 *              |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 4.0289           | 20.7423            | 45.6897 *              |
| 6 22 37.5778  | 4.3855           | 24.0001            | 51.1556 *              |
| 6 23 39.2625  | 4.5813           | 25.0786            | 53.4465 *              |
| 6 24 42.7534  | 4.7823           | 27.9473            | 57.5595 ^<br>59.2879 * |
| 6 26 45.5058  | 4.9832           | 30.0777            | 60.9339 *              |
| 6 27 48.2848<br>6 28 50 0550                          | 5.1117<br>5.2148 | 32.4588            | 64.1108 *<br>66 2003 * |
| 6 29 51.3717  | 5.3220           | 34.8947            | 67.8486 *              |
|   | 5.3051           | 36.2218            | 69.0715 *              |
| 8 3 0.0005  | 0.1555           | -0.4809            | 0.4820                 |
| $ \begin{array}{cccccccccccccccccccccccccccccccccccc$ | 0.1849           | -0.4639            | 0.6811                 |
| 8 6 1.0299  | 0.2750           | 0.1785             | 1.8813 *               |
| 8 7 1.5471  | 0.5098           | -0.0313            | 3.1255                 |
| 8 9 2.9801  | 0.4735           | 1.5142             | 4.4461 *               |
| 8 10 5.0692   | 0.5097           | 3.4912             | 6.6473 *               |
| 8 11 6.9372<br>8 12 9.2054                            | 0.7210           | 4.7049<br>6.2404   | 9.1695 *<br>12.1705 *  |
| 8 13 11.4233  | 1.1815           | 7.7653             | 15.0813 *              |
| 8 14 13.7836<br>8 15 16 5739                          | 1.4523<br>1.7150 | 9.2873<br>11 2643  | 18.2798 *<br>21.8834 * |
| 8 16 19.2099  | 1.9891           | 13.0517            | 25.3681 *              |
| 8 17 22.0378  | 2.3034           | 14.9063            | 29.1693 *              |
| 8 19 29.5598  | 2.8325           | 20.7904            | 38.3292 *              |
| 8 20 32.3587  | 3.1552           | 22.5899            | 42.1274 *              |
| 8 22 37.0165  | 3.3028<br>3.4839 | 22.9378            | 44.6273 *<br>47.8027 * |
| 8 23 38.9262  | 3.5378           | 27.9731            | 49.8793 *              |
| 8 24 42 5224<br>8 25 43 9980                          | 3.6598<br>3.7515 | 31.1917<br>32.3831 | 53.8532 *<br>55.6128 * |
| 8 26 45.4082  | 3.8278           | 33.5572            | 57.2591 *              |

| 8                    | 27                   | 48.0913                                  | 4.0230                               | 35.6360                                  | 60.5466 *  |
|----------------------|----------------------|--|--------------------------------------|--|--|
| 8                    | 28                   | 49.7778                                  | 4.1368                               | 36.9700                                  | 62.5855 *  |
| 8                    | 29                   | 51.1111                                  | 4.2099                               | 38.0773                                  | 64.1450 *  |
| 8<br>9<br>9<br>9     | 2<br>2<br>3<br>4     | -1.5995<br>-1.7086<br>-1.8016            | 0.1506<br>0.1578<br>0.1833           | -2.0657<br>-2.1970<br>-2.3691            | -1.1332 *<br>-1.2202 *<br>-1.2342 *              |
| 9                    | 5                    | -2.0657                                  | 0.8349                               | -4.6506                                  | 0.5193   |
| 9                    | 6                    | -1.1841                                  | 0.2752                               | -2.0361                                  | -0.3321 *  |
| 9                    | 7                    | -0.6669                                  | 0.5141                               | -2.2584                                  | 0.9247   |
| 9                    | 8                    | -0.9737                                  | 0.2290                               | -1.6828                                  | -0.2646 *  |
| 9                    | 9                    | 5.0538                                   | 0.2597                               | 4.2499                                   | 5.8578 *   |
| 9                    | 10                   | -0.6571                                  | 0.3667                               | -1.7924                                  | 0.4783   |
| 9                    | 11                   | -0.3891                                  | 0.5800                               | -2.1849                                  | 1.4067   |
| 9                    | 12                   | 0.3435                                   | 0.8307                               | -2.2282                                  | 2.9153   |
| 9                    | 13                   | 1.2514                                   | 1.0723                               | -2.0686                                  | 4.5714   |
| 9                    | 14                   | 2.1907                                   | 1.2989                               | -1.8307                                  | 6.2122   |
| 9                    | 15                   | 3.5351                                   | 1.6612                               | -1.6080                                  | 8.6781   |
| 9                    | 16                   | 4.9687                                   | 1.8823                               | -0.8590                                  | 10.7964  |
| 9                    | 17                   | 6.4795                                   | 2.1914                               | -0.3050                                  | 13.2641  |
| 9                    | 18                   | 7.4347                                   | 2.3443                               | 0.1767                                   | 14.6927 *  |
| 9                    | 19                   | 11.4757                                  | 2.7148                               | 3.0705                                   | 19.8809 *  |
| 9<br>9<br>9          | 20<br>21<br>22<br>23 | 13.7922<br>16.2262                       | 2.9614<br>3.4418<br>3.2383<br>3.4090 | 4.1180<br>3.1364<br>6.2003<br>6.7815     | 22.4551 ^<br>24.4480 *<br>26.2521 *              |
| 9                    | 24                   | 20.0837                                  | 3.5567                               | 9.0720                                   | 31.0953 *  |
| 9                    | 25                   | 20.9592                                  | 3.5937                               | 9.8329                                   | 32.0854 *  |
| 9                    | 26                   | 21.6694                                  | 3.6974                               | 10.2220                                  | 33.1167 *  |
| 9                    | 27                   | 23.8446                                  | 3.8578                               | 11.9007                                  | 35.7885 *  |
| 9                    | 28                   | 25.1511                                  | 4.0408                               | 12.6406                                  | 37.6617 *  |
| 9                    | 29                   | 25.9844                                  | 4.0626                               | 13.4066                                  | 38.5623 *  |
| 9                    | 30                   | 26.7511                                  | 4.1704                               | 13.8394                                  | 39.6628 *  |
| 12                   | 2                    | -0.1772                                  | 0.4483                               | -1.5651                                  | 1.2107   |
| 12                   | 3                    | -0.2096                                  | 0.4292                               | -1.5384                                  | 1.1193   |
| 12                   | 4                    | -0.2134                                  | 0.4172                               | -1.5049                                  | 1.0782   |
| 12                   | 5                    | -0.5258                                  | 0.8727                               | -3.2277                                  | 2.1761   |
| 12                   | 6                    | 0.5197                                   | 0.4413                               | -0.8465                                  | 1.8859   |
| 12                   | 7                    | 0.9468                                   | 0.5803                               | -0.8498                                  | 2.7435   |
| 12                   | 8                    | 0.6238                                   | 0.3803                               | -0.5537                                  | 1.8013   |
| 12                   | 9                    | 2.9107                                   | 2.4552                               | -4.6907                                  | 10.5120  |
| 12<br>12<br>12<br>12 | 10<br>11<br>12       | -0.5422<br>1.6168<br>1.6916              | 0.3572<br>0.3284                     | -8.9601<br>0.5109<br>0.6748              | 7.8757<br>2.7226 *<br>2.7084 *                   |
| 12<br>12<br>12<br>12 | 13<br>14<br>15<br>16 | 5.3227<br>5.3080<br>7.2590<br>9.3408     | 0.0720<br>0.9964<br>1.3309<br>1.6323 | 2.2230<br>3.1384<br>4.2871               | 8.3930 *<br>11.3797 *<br>14.3945 *               |
| 12<br>12<br>12<br>12 | 17<br>18<br>19       | 11.4688<br>13.1215<br>17.0391            | 1.9449<br>2.2687<br>2.6737           | 5.4472<br>6.0974<br>8.7612               | 17.4903 *<br>20.1456 *<br>25.3171 *              |
| 12                   | 20                   | 19.3281                                  | 2.9330                               | 10.2474                                  | 28.4088 *  |
| 12                   | 21                   | 20.2276                                  | 3.3947                               | 9.7175                                   | 30.7378 *  |
| 12                   | 22                   | 23.1616                                  | 3.3450                               | 12.8053                                  | 33.5178 *  |
| 12                   | 23                   | 24.6824                                  | 3.5253                               | 13.7679                                  | 35.5969 *  |
| 12                   | 24                   | 27.5585                                  | 3.7240                               | 16.0288                                  | 39.0882 *  |
| 12                   | 25                   | 28.7785                                  | 3.8713                               | 16.7928                                  | 40.7641 *  |
| 12                   | 26                   | 29.9442                                  | 4.0712                               | 17.3398                                  | 42.5486 *  |
| 12                   | 27                   | 32.2366                                  | 4.4301                               | 18.5209                                  | 45.9523 *  |
| 12                   | 28                   | 33.8178                                  | 4.5476                               | 19.7383                                  | 47.8973 *  |
| 12<br>12<br>13       | 29<br>30<br>2        | 34.9511<br>36.0289<br>1.4167<br>1.3075   | 4.6533<br>4.7929<br>0.1517<br>0.1573 | 20.3444<br>21.1900<br>0.9470             | 49.3578 *<br>50.8677 *<br>1.8864 *               |
| 13<br>13<br>13       | 5<br>4<br>5<br>6     | 1.2145<br>0.8515<br>1.6338               | 0.1373<br>0.1865<br>0.8342<br>0.2729 | 0.8204<br>0.6370<br>-1.7314<br>0.7889    | 1.7921 *<br>3.4343<br>2.4787 *                   |
| 13                   | 7                    | 1.9497                                   | 0.5109                               | 0.3679                                   | 3.5315 *   |
| 13                   | 8                    | 1.4417                                   | 0.2311                               | 0.7262                                   | 2.1572 *   |
| 13                   | 9                    | 1.6645                                   | 0.2579                               | 0.8660                                   | 2.4630 *   |
| 13                   | 10                   | 2.2032                                   | 0.3345                               | 1.1675                                   | 3.2390 *   |
| 13                   | 11                   | 2.2826                                   | 0.2204                               | 1.6003                                   | 2.9649 *   |
| 13                   | 12                   | 2.4192                                   | 0.2284                               | 1.7120                                   | 3.1263 *   |
| 13                   | 13                   | 2.4479                                   | 0.2401                               | 1.7045                                   | 3.1914 *   |
| 13                   | 14                   | 4.9357                                   | 0.4976                               | 3.3952                                   | 6.4762 *   |
| 13                   | 15                   | 7.4448                                   | 0.8101                               | 4.9366                                   | 9.9530 *   |
| 13<br>13<br>13       | 16<br>17<br>18       | 10.0023<br>12.6283<br>14.8438            | 1.0035<br>1.2690<br>1.5061           | 6.8953<br>8.6995<br>10.1809              | 13.1093 *<br>16.5572 *<br>19.5067 *<br>24.5778 * |
| 13<br>13<br>13<br>12 | 19<br>20<br>21       | 10.901/<br>21.6798<br>22.9874<br>26.4214 | 2.0406<br>2.4985<br>2.5099           | 13.3456<br>15.3621<br>15.2520<br>18.6505 | 24.3778 *<br>27.9975 *<br>30.7228 *<br>34.1922 * |
| 13                   | 23                   | 28.2311                                  | 2.6120                               | 20.1442                                  | 36.3179 *  |
| 13                   | 24                   | 31.3327                                  | 2.6147                               | 23.2374                                  | 39.4279 *  |
| 13                   | 25                   | 32 9082                                  | 2.6995                               | 24 5505                                  | 41.2658 *  |
| 13                   | 26                   | 34.5184                                  | 2.8509                               | 25.6919                                  | 43.3449 *  |

| 13                   | 27                   | 37.0728                       | 3.0739                               | 27.5559                                  | 46.5897 *  |
|----------------------|----------------------|-------------------------------|--------------------------------------|--|--|
| 13                   | 28                   | 38.9278                       | 3.1079                               | 29.3057                                  | 48.5499 *  |
| 13                   | 29                   | 40.3611                       | 3.2026                               | 30.4458                                  | 50.2765 *  |
| 13<br>14<br>14<br>14 | 2<br>2<br>3<br>4     | 1.3525<br>1.3609<br>1.2481    | 0.2181<br>0.3077<br>0.4229           | 0.6772<br>0.4083<br>-0.0614              | 2.0278 *<br>2.3135 *<br>2.5575                   |
| 14                   | 5                    | 0.7047                        | 0.8948                               | -2.0656                                  | 3.4750   |
| 14                   | 6                    | 1.3757                        | 0.4686                               | -0.0752                                  | 2.8265   |
| 14                   | 7                    | 1.3035                        | 0.6446                               | -0.6922                                  | 3.2993   |
| 14                   | 8                    | 0.4670                        | 0.4774                               | -1.0111                                  | 1.9451   |
| 14                   | 9                    | 0.1600                        | 0.5962                               | -1.6859                                  | 2.0059   |
| 14                   | 10                   | 0.4567                        | 0.7801                               | -1.9586                                  | 2.8719   |
| 14                   | 11                   | 0.1400                        | 0.7429                               | -2.1600                                  | 2.4400   |
| 14                   | 12                   | 0.1940                        | 0.7600                               | -2.1591                                  | 2.5470   |
| 14                   | 13                   | 0.2238                        | 0.7027                               | -1.9517                                  | 2.3993   |
| 14                   | 14                   | 0.2619                        | 0.6646                               | -1.7957                                  | 2.3195   |
| 14                   | 15                   | 0.6995                        | 1.2889                               | -3.2909                                  | 4.6899   |
| 14                   | 16                   | 1.5478                        | 1.7853                               | -3.9794                                  | 7.0751   |
| 14                   | 17                   | 2.5446                        | 2.2954                               | -4.5619                                  | 9.6512   |
| 14                   | 18                   | 3.4382                        | 2.7631                               | -5.1165                                  | 11.9928  |
| 14                   | 19                   | 6.0207                        | 3.2195                               | -3.9468                                  | 15.9883  |
| 14                   | 20                   | 7.5615                        | 3.6085                               | -3.6103                                  | 18.7334  |
| 14                   | 21                   | 7.8285                        | 4.2459                               | -5.3169                                  | 20.9738  |
| 14                   | 22                   | 10.2291                       | 4.4023                               | -3.4007                                  | 23.8589  |
| 14                   | 23                   | 11.2722                       | 4.6867                               | -3.2379                                  | 25.7822  |
| 14                   | 24                   | 13.4561                       | 5.0091                               | -2.0523                                  | 28.9645  |
| 14                   | 25                   | 14.3316                       | 5.2906                               | -2.0481                                  | 30.7113  |
| 14                   | 26                   | 15.1918                       | 5.6466                               | -2.2903                                  | 32.6740  |
| 14                   | 27                   | 17.1185                       | 5.8195                               | -0.8989                                  | 35.1359  |
| 14                   | 28                   | 18.4422                       | 6.0752                               | -0.3667                                  | 37.2512  |
| 14                   | 29                   | 19.3922                       | 6.2705                               | -0.0215                                  | 38.8060  |
| 14                   | 30                   | 20.3756                       | 6.4266                               | 0.4785                                   | 40.2726 *  |
| 15                   | 2                    | 0.7498                        | 0.2362                               | 0.0185                                   | 1.4811 *   |
| 15<br>15<br>15       | 5<br>4<br>5<br>6     | 0.5076                        | 0.3021<br>0.9192<br>0.6445           | -0.4275<br>-3.0224<br>-1.2435            | 1.4428<br>2.6695<br>2.7474                       |
| 15                   | 7                    | 1.3035                        | 0.5169                               | -0.2967                                  | 2.9038   |
| 15                   | 8                    | 1.0042                        | 0.3093                               | 0.0467                                   | 1.9617 *   |
| 15                   | 9                    | 1.2347                        | 0.2935                               | 0.3259                                   | 2.1435 *   |
| 15                   | 10                   | 1.9647                        | 0.3464                               | 0.8922                                   | 3.0371 *   |
| 15                   | 11                   | 1.9947                        | 0.2401                               | 1.2512                                   | 2.7381 *   |
| 15                   | 12                   | 2.2443                        | 0.2339                               | 1.5203                                   | 2.9684 *   |
| 15                   | 13                   | 2.4312                        | 0.2522                               | 1.6504                                   | 3.2120 *   |
| 15                   | 14                   | 2.3632                        | 0.2682                               | 1.5327                                   | 3.1936 *   |
| 15                   | 15                   | 2.0863                        | 0.2857                               | 1.2018                                   | 2.9708 *   |
| 15                   | 16                   | 4.4417                        | 0.5558                               | 2.7209                                   | 6.1626 *   |
| 15                   | 17                   | 6.6920                        | 0.8155                               | 4.1671                                   | 9.2169 *   |
| 15                   | 18                   | 8.6219                        | 1.0473                               | 5.3794                                   | 11.8644 *  |
| 15<br>15<br>15       | 19<br>20<br>21       | 11.8360<br>14.2006<br>15.2610 | 1.3453<br>1.6083<br>2.1957           | 7.6708<br>9.2212<br>8.4630               | 16.0012 *<br>19.1801 *<br>22.0590 *<br>24.0025 * |
| 15<br>15<br>15       | 22<br>23<br>24<br>25 | 20.5047<br>23.4759<br>25.2180 | 2.0333<br>2.1643<br>2.2578<br>2.4376 | 12.1874<br>13.8040<br>16.4857<br>17.6712 | 24.9023 *<br>27.2054 *<br>30.4660 *<br>32.7648 * |
| 15                   | 26                   | 26.7782                       | 2.5680                               | 18.8276                                  | 34.7288 *  |
| 15                   | 27                   | 29.0058                       | 2.8996                               | 20.0286                                  | 37.9830 *  |
| 15                   | 28                   | 30.4289                       | 2.9539                               | 21.2834                                  | 39.5743 *  |
| 15                   | 29                   | 31.4956                       | 3.0185                               | 22.1502                                  | 40.8409 *  |
| 15                   | 30                   | 32.5456                       | 3.1222                               | 22.8791                                  | 42.2120 *  |
| 16                   | 2                    | -0.5667                       | 0.7672                               | -2.9419                                  | 1.8085   |
| 16                   | 3                    | -0.5415                       | 0.7526                               | -2.8714                                  | 1.7885   |
| 16                   | 4                    | -0.5678                       | 0.7762                               | -2.9710                                  | 1.8355   |
| 16                   | 5                    | -0.8349                       | 0.9218                               | -3.6889                                  | 2.0190   |
| 16                   | 6                    | 0.0918                        | 0.8082                               | -2.4103                                  | 2.5940   |
| 16                   | 7                    | 0.4118                        | 0.8272                               | -2.1491                                  | 2.9727   |
| 16                   | 8                    | -0.0009                       | 0.9514                               | -2.9463                                  | 2.9446   |
| 16<br>16<br>16       | 9<br>10<br>11<br>12  | 0.1229<br>0.8046<br>0.8170    | 0.9668<br>0.9542<br>0.9763           | -2.8705<br>-2.1496<br>-2.2055            | 3.1162<br>3.7587<br>3.8395                       |
| 16<br>16<br>16       | 13<br>14<br>15       | 1.0359<br>1.0681<br>0.8555    | 1.0044<br>0.9560<br>0.9313           | -2.0304<br>-2.0739<br>-1.8917<br>-2.0279 | 4.0013<br>4.1457<br>4.0280<br>3.7388             |
| 16                   | 16                   | 1.1863                        | 0.8814                               | -1.5427                                  | 3.9152   |
| 16                   | 17                   | 2.2625                        | 1.8166                               | -3.3617                                  | 7.8866   |
| 16                   | 18                   | 3.1278                        | 2.6728                               | -5.1474                                  | 11.4030  |
| 16                   | 19                   | 5.1037                        | 3.5509                               | -5.8900                                  | 16.0974  |
| 16                   | 20                   | 6.3933                        | 4.5314                               | -7.6362                                  | 20.4227  |
| 16                   | 21                   | 6.4006                        | 5.7196                               | -11.3073                                 | 24.1086  |
| 16                   | 22                   | 8.5346                        | 6.3787                               | -11.2139                                 | 28.2832  |
| 16                   | 23                   | 9.2777                        | 7.3387                               | -13.4430                                 | 31.9983  |
| 16                   | 24                   | 10.8980                       | 8.3663                               | -15.0044                                 | 36.8003  |
| 16                   | 25                   | 11.4068                       | 9.2400                               | -17.2005                                 | 40.0141  |
| 16                   | 26                   | 11.9170                       | 10.0021                              | -19.0498                                 | 42.8838  |

| $\begin{array}{c} 166667777777777777777777777777777777888888$                          | $\begin{array}{c} 27\\ 28\\ 29\\ 0\\ 2\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 12\\ 3\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 22\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 11\\ 23\\ 4\\ 5\\ 6\\ 7\\ 8\\ 9\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10\\ 10$ | $\begin{array}{c} 13.3076\\ 14.2333\\ 14.8333\\ 14.8333\\ 15.5000\\ 0.3158\\ 0.2049\\ 0.0337\\ -0.4133\\ 0.4601\\ 0.8334\\ 0.4438\\ 0.6454\\ 1.4257\\ 1.4553\\ 1.7247\\ 1.9000\\ 1.9338\\ 1.8585\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 8.5048\\ 9.3985\\ 2.1520\\ 1.9272\\ 3.8029\\ 6.3166\\ 3.9755\\ 3.9755\\ 3.9755\\ 4.9551\\ 3.6986\\ 3.9755\\ 4.9551\\ 5.5400\\ 5.9400\\ 6.3067\\ 0.5040\\ 0.4333\\ 3.6986\\ 3.9755\\ 4.9551\\ 5.5400\\ 5.9400\\ 6.3067\\ 0.5040\\ 0.4333\\ 3.6986\\ 3.9755\\ 4.9551\\ 5.5400\\ 5.9400\\ 6.3067\\ 0.5040\\ 0.4333\\ 3.6986\\ 3.9755\\ 4.9551\\ 5.5400\\ 5.9400\\ 6.3067\\ 0.5040\\ 0.4484\\ 0.4333\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0.4333\\ 0.868\\ 0$ | 11.0785<br>11.7647<br>12.4654<br>13.0063<br>0.9029<br>0.8292<br>0.7793<br>0.8976<br>0.6542<br>0.6826<br>0.6144<br>0.5536<br>0.5405<br>0.4830<br>0.5113<br>0.4845<br>0.5105<br>0.4932<br>0.4920<br>0.4431<br>0.8730<br>1.3391<br>1.7596<br>2.4239<br>2.5202<br>2.9149<br>3.2753<br>3.5956<br>3.9011<br>4.2970<br>4.5659<br>4.8020<br>5.0145<br>0.9460<br>0.9232<br>0.8137<br>0.6404<br>0.5346<br>0.5465<br>3.9011<br>4.2970<br>4.5659<br>4.8020<br>5.0145<br>0.9232<br>0.8137<br>0.6404<br>0.5346<br>0.5652<br>0.9784<br>1.3234<br>1.3234<br>1.4660<br>1.2777<br>0.6745<br>0.6298<br>3.9365<br>3.3672<br>3.7921<br>4.1955<br>4.4622<br>5.0918<br>5.2553<br>5.4194<br>0.2882<br>0.3075 | $\begin{array}{c} -20.9917\\ -22.1906\\ -23.7599\\ -24.7678\\ -2.3789\\ -2.3623\\ -2.3789\\ -3.1924\\ -1.5654\\ -1.2799\\ -1.4585\\ -1.0687\\ -0.2477\\ -0.0402\\ 0.1415\\ 0.4001\\ 0.3532\\ 0.3316\\ 0.6287\\ 0.5554\\ 1.10011\\ 2.1707\\ 3.0571\\ 1.8940\\ 4.6049\\ 5.0426\\ 6.2924\\ 6.7010\\ 7.1155\\ 7.9681\\ 8.7306\\ 9.3329\\ 9.9917\\ -3.8555\\ -3.9530\\ -3.9948\\ -4.4355\\ -3.3884\\ -2.6189\\ -2.5207\\ -2.2752\\ -1.8999\\ -3.6690\\ -5.4234\\ -5.6813\\ -4.7117\\ -3.9599\\ -3.6690\\ -5.4234\\ -5.6813\\ -4.7117\\ -3.9599\\ -4.9484\\ -1.9898\\ -1.7789\\ -8.0206\\ -4.3380\\ -7.7265\\ -6.8050\\ -7.9383\\ -8.2674\\ -9.2907\\ -9.8413\\ -9.9250\\ -10.2244\\ -10.3307\\ -10.4718\\ -0.3821\\ -0.5187\\ \end{array}$ | 47.6069<br>50.6573<br>53.4265<br>55.7678<br>3.1112<br>2.7722<br>2.4463<br>2.3659<br>2.4856<br>2.9468<br>2.3461<br>2.3594<br>3.0990<br>2.9507<br>3.3078 * *<br>3.3999 *<br>3.5145 *<br>3.2989 *<br>6.5056 *<br>10.4625 *<br>10.46 |
|--|---|--|--|---|--|
| $\begin{array}{c} 18\\ 18\\ 18\\ 18\\ 19\\ 19\\ 19\\ 19\\ 19\\ 19\\ 19\\ 19\\ 19\\ 19$ | 236         27           28         29         30           23         4         5         6           7         8         9         10         11           12         13         14         16         17         18         190         21         23         4         25         26  | 3.9755<br>4.9551<br>5.5400<br>6.3067<br>0.5040<br>0.4484<br>0.4333<br>0.1129<br>1.1072<br>1.5301<br>1.1022<br>1.2990<br>2.0126<br>2.0835<br>2.2451<br>2.3600<br>2.3730<br>2.1968<br>2.5758<br>2.3666<br>2.2613<br>2.1438<br>4.3266<br>5.2587<br>8.3069<br>9.9524<br>12.0173<br>13.3143<br>14.5245  | $\begin{array}{c} 4.423\\ 4.4628\\ 4.8062\\ 5.0918\\ 5.2553\\ 5.4194\\ 0.2882\\ 0.2928\\ 0.3075\\ 0.9097\\ 0.3594\\ 0.5574\\ 0.3894\\ 0.3842\\ 0.4013\\ 0.3163\\ 0.3085\\ 0.3059\\ 0.2958\\ 0.3059\\ 0.2958\\ 0.2754\\ 0.3532\\ 0.3084\\ 0.2958\\ 0.2754\\ 0.2628\\ 0.2754\\ 0.2628\\ 0.5640\\ 1.6991\\ 1.0745\\ 1.3050\\ 1.5340\\ 1.7776\\ 2.0097\\ \end{array}$  | $\begin{array}{c} -9.8413\\ -9.9250\\ -10.2244\\ -10.3307\\ -10.4718\\ -0.3882\\ -0.4581\\ -0.5187\\ -2.7034\\ -0.0056\\ -0.1957\\ -0.1034\\ 0.1095\\ 0.7703\\ 1.1042\\ 1.2900\\ 1.4129\\ 1.4586\\ 1.1033\\ 1.6209\\ 1.4508\\ 1.4086\\ 1.3302\\ 2.5806\\ -0.0018\\ 4.9803\\ 5.9122\\ 7.2680\\ 7.8108\\ 8.3025\end{array}$   | 17.7923<br>19.8352<br>21.3044<br>22.2107<br>23.0851<br>1.3961<br>1.3549<br>1.3853<br>2.9293<br>2.2201<br>3.2559<br>2.3078<br>2.4885 *<br>3.2549 *<br>3.2549 *<br>3.2649 *<br>3.2649 *<br>3.2003 *<br>3.2003 *<br>3.2824 *<br>3.2903 *<br>3.2824 *<br>3.2903 *<br>3.2824 *<br>3.2903 *<br>3.2824 *<br>3.2903 *<br>3.2824 *<br>3.2907 *<br>3.2877 *<br>3.2977 *    |

| 19                   | 27             | 16.2679                       | 2.3047                     | 9.1323                        | 23.4034 *                        |
|----------------------|----------------|-------------------------------|----------------------------|-------------------------------|----------------------------------|
| 19                   | 28             | 17.6113                       | 2.5242                     | 9.7963                        | 25.4262 *                        |
| 19                   | 29             | 18.7089                       | 2.7184                     | 10.2926                       | 27.1252 *                        |
| 19                   | 30             | 19.7256                       | 2.9214                     | 10.6808                       | 28.7704 *                        |
| 20                   | 2              | -1.7185                       | 0.7305                     | -3.9801                       | 0.5432                           |
| 20                   | 3              | -1.6933                       | 0.6929                     | -3.8387                       | 0 4521                           |
| 20                   | 4              | -1.6179                       | 0.6594                     | -3.6595                       | 0.4237                           |
| 20                   | 5              |                               | 0.9673                     | -4.9154                       | 1.0739                           |
| 20<br>20<br>20       | 7              | -0.4376                       | 0.8884<br>0.9066<br>0.8747 | -3.2444<br>-3.3885            | 2.3691                           |
| 20                   | 9              | -0.4549                       | 0.8287                     | -3.0205                       | 2.1107                           |
| 20                   | 10             | 0.4307                        | 0.7614                     | -1.9267                       | 2.7881                           |
| 20                   | 11             | 0.5111                        | 0.6503                     | -1.5023                       | 2.5245                           |
| 20<br>20<br>20       | 12<br>13<br>14 | 0.8535<br>1.0699              | 0.5838<br>0.5376<br>0.4951 | -0.9539<br>-0.5946<br>-0.4988 | 2.6609<br>2.7344<br>2.5670       |
| 20                   | 15             | 1.0941                        | 0.4925                     | -0.4308                       | 2.6191                           |
| 20                   | 16             | 1.4870                        | 0.4613                     | 0.0588                        | 2.9151 *                         |
| 20<br>20<br>20       | 17<br>18<br>19 | 1.3422<br>1.3376<br>1.5785    | 0.4880<br>0.4276<br>0.4348 | 0.0137<br>0.2325              | 2.8530<br>2.6615 *<br>2.9246 *   |
| 20                   | 20             | 1.6029                        | 0.4111                     | 0.3300                        | 2.8758 *                         |
| 20                   | 21             | 2.0356                        | 1.6914                     | -3.2011                       | 7.2723                           |
| 20                   | 22             | 4.7362                        | 1.1742                     | 1.1009                        | 8.3716 *                         |
| 20                   | 23             | 6.0793                        | 1.4373                     | 1.6292                        | 10.5293 *                        |
| 20                   | 24             | 7.8500                        | 1.7090                     | 2.5588                        | 13.1412 *                        |
| 20                   | 25             | 9.0588                        | 1.9326                     | 3.0756                        | 15.0421 *                        |
| 20                   | 26             | 10.3357                       | 2.0722                     | 3.9202                        | 16.7513 *                        |
| 20                   | 27             |                               | 2.3107                     | 5.0054                        | 19.3135 *                        |
| 20<br>20<br>20       | 28<br>29<br>30 | 15.0433<br>15.0433<br>16.4100 | 2.7245                     | 6.6083<br>7.7704              | 23.4784 *<br>25.0496 *           |
| 21                   | 2              | 0.8134                        | 0.1496                     | 0.3502                        | 1.2767 *                         |
| 21                   | 3              | 1.0059                        | 0.1579                     | 0.5171                        | 1.4947 *                         |
| 21                   | 4              | 1.1140                        | 0.1821                     | 0.5503                        | 1.6777 *                         |
| 21                   | 5              | $0.8515 \\ 1.8350 \\ 2.1510$  | 0.8365                     | -1.7383                       | 3.4413                           |
| 21                   | 6              |                               | 0.2782                     | 0.9737                        | 2.6963 *                         |
| 21                   | 7              |                               | 0.5137                     | 0.5606                        | 3.7413 *                         |
| 21<br>21<br>21       | 8<br>9<br>10   | 1.6429                        | 0.2275<br>0.2617           | 0.9385<br>0.9549              | 2.3474 *<br>2.5754 *<br>3.2253 * |
| 21<br>21<br>21       | 10<br>11<br>12 | 2.0813                        | 0.2213<br>0.2290           | 1.3961<br>1.4080              | 2.7665 *<br>2.8262 *             |
| 21                   | 13             | 1.9614                        | 0.2410                     | 1.2153                        | 2.7075 *                         |
| 21                   | 14             | 1.8921                        | 0.2505                     | 1.1166                        | 2.6676 *                         |
| 21                   | 15             | 1.6150                        | 0.2894                     | 0.7191                        | 2.5110 *                         |
| 21                   | 16             | 1.9008                        | 0.2543                     | 1.1135                        | 2.6881 *                         |
| 21                   | 17             | 1.5897                        | 0.2383                     | 0.8518                        | 2.3276 *                         |
| 21                   | 18             | 1.5842                        | 0.2193                     | 0.9051                        | 2.2632 *                         |
| 21                   | 19             | $1.6160 \\ 1.7194 \\ 0.5495$  | 0.2320                     | 0.8977                        | 2.3343 *                         |
| 21                   | 20             |                               | 0.2379                     | 0.9830                        | 2.4559 *                         |
| 21                   | 21             |                               | 1.8050                     | -5.0388                       | 6.1379                           |
| 21<br>21<br>21<br>21 | 22<br>23<br>24 | 3.1835<br>4.5932<br>6.2204    | 0.4275<br>0.6008<br>0.7595 | 1.8600<br>2.7331<br>3.8690    | 4.5070 *<br>6.4533 *<br>8.5718 * |
| 21<br>21<br>21       | 25<br>26       | 7.2959                        | 0.8758<br>1.0228           | 4.5843<br>5.3395              | 10.0075 *<br>11.6727 *           |
| 21                   | 27             | 10.0239                       | 1.2056                     | 6.2912                        | 13.7566 *                        |
| 21                   | 28             | 11.4078                       | 1.3006                     | 7.3809                        | 15.4346 *                        |
| 21                   | 29             | 12.6411                       | 1.4279                     | 8.2201                        | 17.0621 *                        |
| 21                   | 30             | 13.9078                       | 1.5375                     | 9.1477                        | 18.6678 *                        |
| 24                   | 2              | 0.2354                        | 0.9627                     | -2.7451                       | 3.2159                           |
| 24                   | 3              | -0.5543                       | 0.5337                     | -2.2068                       | 1.0982                           |
| 24                   | 4              | 0.1110                        | 0.4919                     | -1.4120                       | 1.6339                           |
| 24                   | 5              | -0.3024                       | 0.9054                     | -3.1055                       | 2.5007                           |
| 24                   | 6              | 0.6231                        | 0.4656                     | -0.8182                       | 2.0645                           |
| 24                   | 7              | 0.9886                        | 0.5495                     | -0.7126                       | 2.6899                           |
| 24                   | 8              | 0.7153                        | 0.4006                     | -0.5251                       | 1.9557                           |
| 24                   | 9              | 0.9648                        | 0.3705                     | -0.1824                       | 2 1120                           |
| 24<br>24<br>24       | 10<br>11<br>12 | 1.8483                        | 0.3785<br>0.2709           | 0.6765<br>1.1324              | 3.0202 *<br>2.8099 *             |
| 24<br>24<br>24       | 13<br>14       | 2.1620                        | 0.2848<br>0.2849<br>0.3008 | 1.2123<br>1.2800<br>1.1413    | 3.0440 *<br>3.0039 *             |
| 24                   | 15             | 2.2314                        | 0.3213                     | 0.9404                        | 2.9300 *                         |
| 24                   | 16             |                               | 0.2894                     | 1.3356                        | 3.1273 *                         |
| 24                   | 17             |                               | 0.2715                     | 1.2594                        | 2.9403 *                         |
| 24                   | 18             | 2.0978                        | 0.2474                     | 1.3319                        | 2.8636 *                         |
| 24                   | 19             | 2.2669                        | 0.2646                     | 1.4478                        | 3.0859 *                         |
| 24                   | 20             | 2.2511                        | 0.2665                     | 1.4259                        | 3.0764 *                         |
| 24                   | 21             | 0.9559                        | 1.9136                     | -4.9688                       | 6.8806                           |
| 24                   | 22             | 3.2308                        | 1.9089                     | -2.6791                       | 9.1407                           |
| 24                   | 23             | 1.7339                        | 0.2137                     | 1.0723                        | 2.3954 *                         |
| 24                   | 24             | 1.6198                        | 0.1938                     | 1.0197                        | 2.2199 *                         |
| 24                   | 25             | 2.9753                        | 0.3445                     | 1.9088                        | 4.0418 *                         |
| 24                   | 26             | 4.2455                        | 0.5227                     | 2.6271                        | 5.8639 *                         |

| $\begin{array}{c} 24\\ 24\\ 24\\ 24\\ 27\\ 27\\ 27\\ 27\\ 27\\ 27\\ 27\\ 27\\ 27\\ 27$ | 2789932345678901123415678901223456789023456789011234567890112345678901122222222222222222222222222222222222 | 5.8024<br>7.1156<br>8.3889<br>9.6156<br>0.3366<br>0.5343<br>0.4732<br>-0.2029<br>0.5787<br>0.5412<br>-0.1915<br>-0.2387<br>0.4546<br>0.5367<br>0.4546<br>0.5367<br>0.6219<br>0.4546<br>0.5367<br>0.6219<br>0.5440<br>0.9812<br>0.8464<br>1.0251<br>1.0466<br>-0.1421<br>2.2660<br>0.8421<br>0.6842<br>1.0466<br>-0.1421<br>2.2660<br>0.8421<br>0.6841<br>0.6855<br>1.6500<br>2.6000<br>3.5833<br>-1.9114<br>-1.2929<br>-0.8737<br>-1.2332<br>-0.9078<br>-0.0617<br>0.0688<br>0.4590<br>0.6569<br>0.7899<br>0.7644<br>1.0382<br>1.2748<br>1.0436<br>1.0382<br>1.2748<br>1.0382<br>1.2748<br>1.0382<br>1.1011<br>0.9989<br>2.0822<br>3.0489 | 0.7258<br>0.8752<br>1.0115<br>1.1575<br>0.7749<br>0.7908<br>0.7464<br>0.9153<br>0.6650<br>0.6819<br>0.7501<br>0.6902<br>0.7049<br>0.6698<br>0.6352<br>0.6049<br>0.5284<br>0.4608<br>0.4156<br>0.3905<br>0.4222<br>1.9159<br>1.9356<br>0.3870<br>0.3413<br>0.2787<br>0.4654<br>0.6095<br>0.7775<br>0.4477<br>0.4561<br>0.4540<br>0.8293<br>0.3905<br>0.5372<br>0.3900<br>0.4477<br>0.4561<br>0.4540<br>0.8293<br>0.3905<br>0.5372<br>0.3900<br>0.4477<br>0.4541<br>0.4540<br>0.8293<br>0.3905<br>0.5372<br>0.3900<br>0.4071<br>0.4587<br>0.4754<br>0.4557<br>0.44754<br>0.45398<br>0.4754<br>0.4754<br>0.45398<br>0.4754<br>0.4754<br>0.45398<br>0.4754<br>0.5398<br>0.4726<br>0.3446<br>0.3152<br>1.8564<br>0.2431<br>0.2221<br>0.2983<br>0.2921<br>0.2162<br>0.2983<br>0.4057<br>0.4057 | 3.5552<br>4.4060<br>5.2573<br>6.0318<br>-2.0626<br>-1.9140<br>-1.8377<br>-2.8547<br>-1.5051<br>-1.7243<br>-2.2503<br>-2.3499<br>-1.9350<br>-1.8582<br>-1.7277<br>-1.5371<br>-1.3446<br>-0.5933<br>-0.4404<br>-0.2605<br>-6.0737<br>-3.7268<br>-0.3560<br>-0.1233<br>-0.2290<br>-0.1233<br>-0.02440<br>-0.2290<br>-0.1233<br>-0.0024<br>0.2092<br>0.7129<br>1.1760<br>-3.2975<br>-3.8277<br>-3.4191<br>-4.8480<br>-2.5019<br>-2.5370<br>-2.4408<br>-2.1681<br>-1.4818<br>-1.4031<br>-0.8348<br>-0.8813<br>-0.7414<br>-0.2290<br>0.2190<br>0.2080<br>0.3525<br>-5.6138<br>-3.2653<br>0.2771<br>0.4754<br>0.2681<br>-0.2605<br>-5.6138<br>-0.2771<br>0.4754<br>0.2680<br>0.3618<br>0.1775<br>0.3821<br>0.8261<br>1.1821 | 8.0496 *<br>9.8251 *<br>11.5205 *<br>13.1993 *<br>2.7357<br>2.9827<br>2.7841<br>2.8128<br>2.6626<br>2.8068<br>1.8673<br>1.8725<br>2.7096<br>2.6105<br>2.5884<br>2.6173<br>2.2597<br>2.1332<br>2.2341<br>2.3537<br>5.7895<br>8.2588<br>2.0402<br>1.9689<br>1.5971<br>1.4944<br>1.7234<br>*<br>4.4871 *<br>5.9906 *<br>-0.5252 *<br>-0.5584 *<br>-0.6079 *<br>-0.5255 *<br>-0.5584 *<br>-0.6079 *<br>-0.5257 *<br>-0.5584 *<br>-0.6079 *<br>-0.5257 *<br>-0.5584 *<br>-0.5257 *<br>-0.5584 *<br>-0.6079 *<br>-0.5257 *<br>-0.5584 *<br>-0.6079 *<br>-0.5257 *<br>-0.5584 *<br>-0.6079 *<br>-0.5257 *<br>-0.5584 *<br>-0.6079 *<br>-0.5252 *<br>-0.5584 *<br>-0.5252 *<br>-0.5584 *<br>-0.6079 *<br>-0.5252 *<br>-0.5584 *<br>-0.6079 *<br>-0.5252 *<br>-0.5584 *<br>-0.5252 *<br>-0.5584 *<br>-0.6079 *<br>-0.6079 *<br>-0.8591 *<br>-0.859 |
|--|--|---|--|--|--|
| 20   | 50   | 5.0405  | 0.0050   | 1.1021   | 4.5157   |

Signif. codes: `\*' confidence band does not cover 0

Control Group: Not Yet Treated, Anticipation Periods: 0 Estimation Method: Outcome Regression

## Appendix 3. Overall summary of ATT's based on event-study/dynamic aggregation for balance = 6

| ATT<br>6.0012 | 5          | Std. Error<br>0.7579 | - [ 95%<br>9 4.5158 | Conf. Int.]<br>7.4866 * | r.                |
|---------------|------------|----------------------|---------------------|-------------------------|-------------------|
| Dynamic       | Effe       | ects:                | Ctd Farmer          |                         | Conf Dond]        |
| Event         | -22        | 0.2354               | 0.8662              | -2.0107                 | 2.4815            |
|               | -21<br>-20 | -0.5543              | 0.5014<br>0.4866    | -1.8545                 | 0.7459            |
|               | -19        | -0.1164              | 0.7419              | -2.0403                 | 1.8074            |
|               | -18<br>-17 | -0.1149 0.3492       | 0.5251              | -1.4765<br>-0.3959      | 1.2467            |
|               | -16        | -0.0991              | 0.3018              | -0.8818                 | 0.6836            |
|               | -15<br>-14 | 0.0390               | 0.2994              | -0.7836                 | 0.9992            |
|               | -13        | 0.4680               | 0.2586              | -0.2026                 | 1.1386            |
|               | -11        | 0.8014<br>0.7846     | 0.2232              | 0.2058                  | 1.3634            |
|               | -10        | 0.6629               | 0.2399              | 0.0409                  | 1.2849            |
|               | -8         | 1.0609               | 0.2366              | 0.4473                  | 1.6746            |
|               | -7<br>-6   | 0.9900               | 0.2209              | 0.4172                  | 1.5629            |
|               | -5         | 1.2532               | 0.2955              | 0.4868                  | 2.0195            |
|               | -4<br>-3   | 1.2686               | 0.2386              | 0.6500                  | 2.3436            |
|               | -2         | 1.1326               | 0.3198              | 0.3033                  | 1.9619            |
|               | 0          | 1.2908               | 0.1999              | 0.7724                  | 1.8093            |
|               | 1          | 2.9616               | 0.4410<br>0.5805    | 1.8180                  | 4.1051            |
|               | 3          | 5.7783               | 0.6875              | 3.9955                  | 7.5610            |
|               | 45         | 7.4488               | 0.9266<br>1.1129    | 5.0461<br>6.4425        | 9.8516<br>12.2140 |
|               | 6          | 11.0439              | 1.3340              | 7.5847                  | 14.5032           |

Signif. codes: `\*' confidence band does not cover 0

Control Group: Not Yet Treated, Anticipation Periods: 0 Estimation Method: Outcome Regression





Authors' own elaboration.

# Appendix 5. Group-specific effects - ATT's based on event-study/dynamic aggregation

| Overall summary<br>ATT Std<br>16.1951  | of ATT's base<br>. Error [<br>2.4893 11.  | d on group/coh<br>95% Conf. Int<br>3161 21.07  | ort aggregation:<br>.]<br>41 *  |
|--|---|--|---|
| Group Effects:<br>Group Estimate<br>5 28.3468<br>6 26.7391<br>8 27.7286<br>9 12.1260<br>12 19.9719<br>13 23.7518<br>14 9.9831<br>15 18.8211<br>16 8.9588<br>17 14.5528<br>18 3.4494<br>19 11.8465<br>20 8.9959<br>21 7.8329<br>24 5.6804<br>27 2.1735<br>28 2.0433 | Std. Error [9<br>2.8205<br>2.9767<br>2.3338<br>2.5729<br>2.8491<br>2.0404<br>4.0115<br>1.7829<br>6.9714<br>2.8652<br>3.6339<br>1.7035<br>1.7277<br>0.9610<br>0.6651<br>0.5344<br>0.4306 | 5% simult. Co<br>21.1485<br>19.1424<br>21.7726<br>5.5596<br>12.7008<br>18.5446<br>-0.2545<br>14.2711<br>-8.8328<br>7.2406<br>-5.8245<br>7.4992<br>4.5867<br>5.3803<br>3.9829<br>0.8097<br>0.9445 | nf. Band]<br>35.5450 *<br>34.3358 *<br>33.6845 *<br>18.6923 *<br>27.2431 *<br>28.9591 *<br>20.2206<br>23.3711 *<br>26.7504<br>21.8650 *<br>12.7234<br>16.1938 *<br>13.4051 *<br>10.2855 *<br>7.3779 *<br>3.5373 *<br>3.1422 * |
|  |   |  |   |

Signif. codes: `\*' confidence band does not cover  $\boldsymbol{0}$ 

Control Group: Not Yet Treated, Anticipation Periods: 0 Estimation Method: Outcome Regression





# Appendix 7. Calendar-time effects - ATT's based on event-study/dynamic aggregation

| 0veral<br>بر<br>16.03 | ll summary<br>ATT Sto<br>336 | / of ATT's H<br>d. Error<br>1.8557 | Dased on calend<br>[ 95% Conf.<br>12.3965 19 | dar time aggregation<br>Int.]<br>9.6708 * | : |
|-----------------------|------------------------------|------------------------------------|--|---|---|
| Time E                | Effects:                     |                                    |  |   |   |
| Time                  | Estimate                     | Std. Error                         | [95% Simult.                                 | Conf. Bandl                               |   |
| 5                     | 0.3876                       | 0.8540                             | -1.7615                                      | 2.5368                                    |   |
| 6                     | 1.4993                       | 0.4304                             | 0.4162                                       | 2.5825 *                                  |   |
| 7                     | 3.1160                       | 0.5049                             | 1.8455                                       | 4.3865 *                                  |   |
| 8                     | 4.2766                       | 0.7057                             | 2.5005                                       | 6.0527 *                                  |   |
| 9                     | 5.6330                       | 0.9420                             | 3.2622                                       | 8.0037 *                                  |   |
| 10                    | 7.4059                       | 1.0454                             | 4.7751                                       | 10.0368 *                                 |   |
| 11                    | 9.3674                       | 1.2311                             | 6.2694                                       | 12.4655 *                                 |   |
| 12                    | 9.5664                       | 1.4/22                             | 5.8614                                       | 13.2715 *                                 |   |
| 1/                    | 12 1056                      | 1 7385                             | 7.3043                                       | 16 4806 *                                 |   |
| 15                    | 12 9883                      | 2 0987                             | 7 7068                                       | 18 2698 *                                 |   |
| 16                    | 14.4518                      | 2.0742                             | 9,2319                                       | 19.6717 *                                 |   |
| 17                    | 15.7083                      | 2.1446                             | 10.3112                                      | 21.1053 *                                 |   |
| 18                    | 15.8325                      | 2.3149                             | 10.0069                                      | 21.6581 *                                 |   |
| 19                    | 16.9616                      | 2.4190                             | 10.8738                                      | 23.0493 *                                 |   |
| 20                    | 18.2493                      | 2.5405                             | 11.8560                                      | 24.6427 *                                 |   |
| 21                    | 18.9014                      | 3.0137                             | 11.3171                                      | 26.4857 *                                 |   |
| 22                    | 21.8092                      | 2.8426                             | 14.6556                                      | 28.9628 *                                 |   |
| 23                    | 23.3320                      | 3.1/61                             | 15.3391                                      | 31.3249 *                                 |   |
| 24                    | 24.6632                      | 2.8461                             | 17.5007                                      | 31.8257 *                                 |   |
| 20                    | 23.9203                      | 2 2105                             | 10 0020                                      | 33.9900 °                                 |   |
| 20                    | 27.1343                      | 3 3080                             | 18 9578                                      | 36 0608 *                                 |   |
| 28                    | 28 3684                      | 3 4971                             | 19 5676                                      | 37 1692 *                                 |   |
| 29                    | 29.5069                      | 3 7388                             | 20.0978                                      | 38.9159 *                                 |   |
| 30                    | 30.6086                      | 3.6321                             | 21.4679                                      | 39.7492 *                                 |   |

Signif. codes: `\*' confidence band does not cover 0

Control Group: Not Yet Treated, Anticipation Periods: 0 Estimation Method: Outcome Regression

Appendix 8. Event study plot for calendar-time effects of Callaway and Sant'Anna estimator



Authors' own elaboration.

# Appendix 9. FTAEIA with the USA - Event study plot for calendar-time effects of Callaway and Sant'Anna estimator



Authors' own elaboration.

Appendix 10. FTAEIA with the European Union - Event study plot for calendar-tim e effects of Callaway and Sant'Anna estimator



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Authors' own elaboration.

## Appendix 11. FTAEIA with Japan- Event study plot for calendar-time effects of Callaway and Sant'Anna estimator



Authors' own elaboration.