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Trade and sustainability: the impact of the International Tropical Timber Agreements on exports

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Abstract Environmental sustainability standards are often portrayed as a hindrance to trade and growth. A set of novel international environmental agreements (IEAs), the International Tropical Timber Agreements (ITTAs), seeks to promote both. The ITTAs encourage international trade for member nations while requiring sustainable timber practices. This paper uses the ITTAs as a case study to examine whether IEAs can lead to environmental cooperation at the same time as increasing trade. Membership in both the 1983 and 1994 ITTAs is examined for an effect on timber exports. The analysis is conducted using panel data for 165 countries between 1970 and 2011 while controlling for year fixed effects, country fixed effects and country-specific trend terms. Estimated ITTA effects vary by ITTA year, timber category and country type. Logs exports fell for both tropical and non-tropical country members, but these decreases were offset by increases in other timber category exports. Tropical country members increased plywood exports, while non-tropical country ITTA members increased exports of sawn wood and veneer sheets. Total exports of targeted timber were unaffected in non-tropical member countries, while the 1983 ITTA increased total exports for tropical countries. These results together suggest that the sustainability clauses entailed in ITTAs have not decreased total timber exports from member countries, but have shifted exports across timber categories.

Keywords International treaties · International trade · Timber

JEL Classification F18 · F53 · Q56

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1 Introduction

International trade and environmental quality are in many cases inextricably linked. Environmental quality has been shown to vary with international trade in certain cases. In developing countries, international trade frequently leads to "pollution havens" with lowered environmental quality. Efforts to increase environmental regulation are often fought with the logic that increased regulation will lead to decreased trade competitiveness. The following research examines the International Tropical Timber Agreements (ITTAs), international agreements that incorporate both environmental and trade objectives. We examine timber exports from participant countries to asses whether environmental sustainability inhibits trade when the sustainability is implemented as part of an international agreement.

The linkages created by international trade and international environmental agreements (IEAs) complicate interactions between countries. Theoretical models of both have been shown to behave differently with the inclusion of spillovers from the other system (see Jayadevappa and Chhatre 2000; Barrett 1994). The ITTA, by simultaneously incorporating both goals, may leverage the benefits of both systems to create clubs that achieve welfare-improving equilibria in environmental outcomes as well as trade.

The ITTAs are designed to promote a sustainable international timber market. As such, these agreements seek to increase trade and environmental sustainability. The ITTAs prohibit any measure to restrict the trade of timber and timber products (ITTO 1994), but the measures taken to promote sustainability may increase the costs of production. These increased costs could make timber products from member nations less competitive if the costs are passed on to the price of the good. Although the requirements for sustainable timber production are not precisely stated within the ITTAs, member nations are bound by good faith to pursue these sustainable practices. However, given that the ITTAs directly seek to promote timber trade, the resulting impact of these agreements on trade is ambiguous.

The following research examines the impact of ITTA membership on timber exports for member nations. The results contribute to the literature on international trade and environmental sustainability, especially within the context of international environmental agreements. If the ITTAs do not decrease trade, as posited by many, environmental initiatives involving products traded internationally could prove to be less politically controversial in the future. Alternatively, if the ITTAs decrease trade, these impacts will be a relevant consideration in environmental policy discussions.

The effects of the 1983 and 1994 ITTAs are examined as separate variables using OLS and Tobit analysis on panel data for 165 countries between 1970 and 2011. Exports of eight timber categories are examined for ITTA effects. Estimated ITTA effects on timber trade depend on the sample (tropical vs. non-tropical countries) and timber category. Exports of logs decreased for both tropical and non-tropical countries, but were offset by increases in higher-value timber exports. Non-tropical member countries increased sawn wood and veneer sheets exports in response to one or both of the ITTAs under examination, but total exports did not change significantly. Tropical member countries increased plywood exports, and with that total exports, in response to the 1983 ITTA.

Section 2 provides background and offers a literature review. The methods are discussed in Sect. 3. Section 4 describes the data, and Sect. 5 contains the results. Section 6 concludes the discussion.

2 Background

2.1 International Tropical Timber Agreements

The underlying principles of the International Tropical Timber Agreements were developed in conversations held at the 1976 United Nations Conference on Trade and Development (Poore 2003), which, by the time of the 1983 ITTA, contained 168 members nations. The original focus was almost exclusively on collecting trade data. With time, the outline of the agreement evolved to contain trade and environmental goals. Years of dialogue had occurred by the time of the Negotiating Conference in March and November 1983. Seventy countries participated in this conference and negotiation only took five weeks. These countries represented 98 percent of the trade in tropical timber products (Poore 2003). By many accounts, the agreement was seen as promising (Johnson 1985).

2.1.1 Agreement structure and mechanisms

Agreement members are divided into "Producer" and "Consumer" countries, with all producer countries residing in the Tropics (ITTO 1994). Each ITTA is registered with the United Nations and remains in effect until the implementation of the subsequent ITTA. The first ITTA was signed in 1983 and was effective in 1985.

The original ITTA was foremost a trade agreement that included overtures to sustainability (ITTO 1994). The following excerpt from the 1983 ITTA Article I lists objectives,

> ...the objectives of the International Tropical Timber Agreement, 1983 (hereinafter referred to as 'this Agreement') are:
>
> (a) To provide an effective framework for co-operation and consultation between tropical timber producing and consuming members with regard to all relevant aspects of the tropical timber economy.
> (b) To promote the expansion and diversification of international trade in tropical timber and the improvement of structural considerations in the tropical timber market, by taking into account, on the one hand, a long-term increase in consumption and continuity of supplies, and, on the other, prices which are remunerative to producers and equitable for consumers, and the improvement of market access.
> (c) To promote and support research and development with a view to improving forest management and wood utilization.
> (d) To improve market intelligence with a view to ensuring greater transparency in the international tropical timber market.
> (e) To encourage increased and further processing of tropical timber in producing member countries with a view to promoting their industrialization and thereby increasing their export earnings.
> (f) To encourage members to support and develop industrial tropical timber reforestation and forest management activities.
> (g) To improve marketing and distribution of tropical timber exports of producing members.
> (h) To encourage the development of national policies aimed at sustainable utilization and conservations of tropical forests and their genetic resources, and at maintaining the ecological balance in the regions concerned.

The primary creation of the ITTA, and the crucial mechanism through which the changes were to be implemented, is the International Tropical Timber Organization (ITTO). This organization is responsible for "the provision of services such as market information and the approval, funding, and management of projects" (Poore 2003). Annual financial contributions to the ITTO are expected of ITTA members, in order to finance the administrative costs of the ITTO. In 2014 and 2015, these contributions totaled approximately $8 million (ITTO 2016). Membership dues cover a proportion of the administrative cost of operating the ITTO, scaled by the percentage of total votes a country represents. "Tropical" and "non-tropical" groups are given equal control of the ITTO, with distribution of control within these groups stipulated in the ITTA.[1]

The ITTA also organized three committees to be part of the ITTO indefinitely: the Committee on Economic Information and Market Intelligence,[2] the Committee on Reforestation and Forest Management, and the Committee on Forest Industry. Funding for these projects was to come from a "Special Account" that was funded from three sources: the Second Account of the Common Fund for Commodities, regional and international financial institutions, and voluntary contributions.

Although there were many discussions of imposing sanctions on member nations that did not comply with the sustainability aspect of the agreements, these never came to fruition. Only failure to pay dues was given an official punishment—removal of voting rights. The political economy of ITTO voting for funding from the Special Account suggests that there may be political disincentives for non-compliance. At this point, incentives for compliance were not formalized.

The ITTAs are distinct from other IEAs in that they attempt to regulate a natural resource. Most IEA are designed to protect a species or limit environmental pollution (Mitchell 2003). Some IEAs protect specific habitats, but these are only 3 percent of the total. Despite the difference in topic, the ITTAs share two key administrative features with the majority of IEAs. Similarly to most IEAs, the ITTAs were organized through the United Nations. Additionally, the ITTA created an organization—over 150 groups have been created to manage agreements (Mitchell 2003).

The 1983 ITTA and the subsequent versions are highly similar. Most notably, the 1994 ITTA includes a member pledge to reach entirely sustainable production by 2000 (ITTO 1994). This provision, known as the Year 2000 Objective, established the Bali Partnership Fund, which provides resources for producer countries to develop sustainable practices. These funds are administered per the following guidelines ITTO (1994),

[1] Of the 1000 votes held in common by the producing members, 400 were to be equally distributed between the three producing regions, with each region distributing the votes allocated to it equally among its members; 300 votes were to be distributed among the producing members in accordance with the respective shares of the total forest resources of all the producing members, and the remaining 300 in proportion to the average of the values of their net tropical timber exports during the most recent 3 years (Poore 2003, p. 36).

[2] ITTO's economic information and market intelligence action program is concerned with improving the flow of tropical timber from producers and consumers; it is designed to assist member countries in understanding and growing markets for tropical timber and other tropical forest goods and services. The program includes work on timber trade and market data, market access, forest certification, ecosystem services, forest law enforcement and the marketing of tropical timber and non-timber products, among other things http://www.itto.int/economic_market/.

In allocating resources of the Fund, Council shall take into account:

a. The special needs of members whose forest sector's contribution to their economics is adversely affected by the implementation of the strategy for achieving exports of tropical timber and timber products from sustainably managed sources by the year 2000;

b. The needs of members with significant forest areas who establish conservation programs in timber producing countries

Contributions to this fund are entirely voluntary (European Parliament 2003). The Bali Partnership Fund and the Year 2000 Objective are associated with incentives for agreement compliance for producing countries (Poore 2003). These incentives are varied and are usually associated with national plans (e.g. access to national timber for meeting sustainability objectives, financial incentives) (ITTO 2016).

2.1.2 Previous evaluations

Johnson (1985) characterizes the ITTA as an opportunity for sustainable development, but not a guarantee, and recommends that participation in the ITTA come with an explicit offer of financial aid from the ITTO. This analysis came soon after the creation of the 1983 ITTA. Jacobson and Weiss (1995) echo the sentiment of skepticism in regard to the 1983 ITTA and furthered this thought onto the 1994 ITTA. Wilson (1996) characterizes the agreements as weak, but expresses hope for their positive impact on environmental quality. Flejzor (2005) believes that adjustments are needed in the document language. Only Wilson (1996) and Flejzor (2005) make cursory mentions of export trends.

The previous quantitative analyses of the ITTAs disagree on trade impact. Chirchi (2004) shows that the 1983 and 1994 ITTAs reduce exports for participant countries. The study is not a comprehensive examination, however, as it compares eight member countries to eight non-members and employs no additional explanatory variables. When examining a cross section of bilateral trade flow levels, Borsky et al. (2011) find that participation in the 1994 ITTA is linked to increased trade and suggests that participation in the ITTAs is comparable to a membership in an exclusive club. This "club" fosters increased trade within its member nations by strengthening international connections (Borsky et al. 2011). Wilson (1996) shows that exports nearly halved to 12.6 million cubic meters in 1993 from 22.5 million cubic meters in 1987 and ascribes this change to environmental regulation, of which the ITTA is a part. By using a more rigorous empirical approach than Wilson (1996) or Chirchi (2004) and a more extensive time series than (Borsky et al. 2011), our study aims to resolve the disagreeing results from previous literature.

2.2 Trade and the environment

2.2.1 The effect of trade on the environment

The relationship between international trade and environmental quality varies widely depending on the specific environmental good in question (Jayadevappa and Chhatre 2000). Trade has been found to enable concentration of carbon-polluting economic activity in developing countries (Kozul-Wright and Fortunato 2012). In a study of aggregates, aerosol emissions are shown to originate from southeast Asian countries in a magnitude

that cannot be accounted for by the amount of goods consumed by this region (Lin et al. 2016). In contrast, trade can also reduce SO_2 levels in the air (Frankel and Rose 2005). This particular result is portrayed as an income effect, where environmental quality is a luxury good.

Openness to trade increased deforestation in the Brazilian Amazon between 2000 and 2010 (Faria and Almeida 2016). Prospective analysis on the Reduced Emissions from Deforestation and Forest Degradation (REDD) policy of the United Nations has suggested that the policy may lead to significantly increased forest product utilization from European countries due to substitution effects (Jonsson et al. 2012).

The interaction between trade agreements and environmental quality has been studied theoretically. Barrett (1997) suggests that a credible threat of trade sanctions could create a sustainable equilibrium where individual countries contribute optimally to an environmental public good. In a similarly structured game theoretic analysis, trade sanctions are shown to reduce the ability of countries with preferences for environmental quality to credibly threaten noncooperative countries (Circone and Urpelainen 2013). This is a result of the "economic cushioning" provided by the trade sanctions. As a result, trade sanctions may lead to decreased international environmental cooperation. Additional research has posited that the withdrawal of World Trade Organization concessions, which is effectively the imposition of tariffs, could lead to an equilibrium in which environmental quality is maintained (Naghavi 2010).

Trade linkages have been shown to encourage participation in formalized IEAs (see Ahmed et al. 2016; Jinnah 2011). Ederington and Minier (2003) show that environmental regulation within a country may be endogenously selected as a response to the trade flows of specific industries. That is, less stringent environmental regulation may be placed on industries which are import-competing.

2.2.2 The effect of environmental standards on trade

Public debate often includes suggestions that environmental standards lead to increased costs production costs and decreased international competitiveness (Rott and Kennedy 2017). A key paper in the literature, Barrett (1994) shows that weak environmental regulation is more likely in industries that are competing for international for market share. This is shown to be a result of government incentives to capture the market. Kellenberg (2009) finds that decreased environmental regulation enforcement led to almost 10 percent of the growth in US multinational affiliate value added between 1999 and 2003. Relatively lax environmental regulation can lead to increased foreign direct investment (FD1) (List and Co 2000). Chichilnisky (1994) suggests pollution havens may occur in regions with unassigned environmental property rights, even if the trading regions have identical technology.

Other evidence has shown that environmental regulation may have no effect on trade flows. Trade flows between 1970 and 2000 of author-characterized "environmentally sensitive goods," goods that have been subject to environmental regulation, have not systematically changed despite heterogeneous regulation (Xu 2000). A thorough review of economic literature found insignificant and inconclusive effects of environmental regulation on trade flows (Jaffe et al. 1995). Eliste and Fredriksson (2002) suggest the lack of trade flow change may be a result of government policies compensating producers who are newly environmentally regulated.

2.3 International timber market

2.3.1 Market details

Timber is separated into two main categories, hardwood and softwood. Within each category, the following subtypes are most common: oak, maples, mahogany, cherry, walnut, rosewood, and teak for hardwood and pine, ash, hickory, beech, birch, cedar, redwood, hemlock, fir, and spruce for softwood (Jane 1970). Hardwood is typically used for furniture, cabinetry, flooring and millwork. Softwood is typically used to create structures (Jonsson et al. 2012). Mahogany, rosewood and teak are grown only in the tropics. Both softwood and hardwood are grown in the tropics. Between hardwood and softwood there is little substitutability, but there is substantial substitutability within these types (Jonsson et al. 2012).

2.3.2 Sustainability

The ITTA specifically utilizes the "sustainability" terminology. The details of sustainability are not specified within the agreements. The ITTO later developed guides meant to educate member countries (Poore 2003). A review of literature shows that the details of sustainability in the context of timber management may be debatable, but that the broad concepts are fixed across disciplines and researchers. These broad concepts were formative input for the ITTA guides. For a thorough discussion, see Poore (2013). In general, extreme deforestation is prohibited (Merry et al. 2009) while moderate logging is permitted. Wildfire implications are considered at times (Armstrong 2004), as are the impacts of timber product processing (Sharma and Henriques 2005). Ecological literature emphasizes preservation of the unique ecosystems in individual forests (Lindenmayer et al. 2000).

3 Methods

Using data for 1970–2011, our analysis separately estimates models for 95 tropical and 70 non-tropical countries. This follows the ITTAs' different treatment of tropical countries (generally, producers of tropical timber) and non-tropical countries (generally, consumers of tropical timber) (ITTO 1983).

To determine the impact of the 1983 and 1994 ITTAs on trade, timber exports of country i in year t are estimated as the following random growth model (Wooldridge 2010):

$$\text{Exports}_{it} = \beta_1 \text{ITTA}_{it}^{1983} + \beta_2 \text{ITTA}_{it}^{1994} + \beta_3 \text{X}_{it} + \gamma_t + \kappa_i + \lambda_i t + \varepsilon_{it}$$

where ITTA_{it}^{1983} and ITTA_{it}^{1994} are variables indicating ITTA membership for the respective ITTA, X_{it} are other covariates, γ_t are year fixed effects, κ_i are country fixed effects and λ_i are country-specific growth rates. Finally, ε_{it} is the i.i.d. error term.

In addition to year fixed effects that control for annual changes in the global marketplace shared by all countries, the model incorporates country fixed effects and country-specific trend terms. Country fixed effects control for unobserved heterogeneity including factors contributing to self-selection into treaties. Country-specific trend terms control for the growth rate of exports within each country over time—these give rise to the random trend or random growth model discussed in Wooldridge (2010) and recommended by Ringquist and Kostadinova (2004). Table 1 provides the descriptive statistics separately for tropical and non-tropical sample countries.

Table 1 Descriptive statistics

	Obs	Mean	SD	Min	Max
Tropical					
Exports[a]					
Logs[b]	2417	40.0	149.2	0	1683.3
Non-coniferous logs	2311	40.1	150.2	0	1682.2
Coniferous logs	1355	2.6	11.5	0	185.4
Sawn wood	2730	40.2	131.8	0	1774.3
Non-coniferous sawn wood	2642	34.8	123.9	0	1718.2
Coniferous sawn wood	1802	9.9	40.4	0	553.4
Plywood	1784	8.6	24.2	0	274.1
Veneer sheets	2049	57.3	314.2	0	4227.2
Total[c]	1504	210.4	588.8	0	4622.6
ITTA					
1983 ITTA	2730	0.09	0.29	0	1
1994 ITTA	2730	0.17	0.38	0	1
Covariates					
Market potential	2730	5.09	2.30	1.06	16.17
GDP per capita	2730	3.15	5.27	0.05	35.32
GDP per capita^2	2730	37.67	132.60	0.00	1247.24
Population	2730	32.92	115.55	0.04	1241.49
Year	2730	1994.34	11.52	1970	2011
Non-tropical					
Exports[a]					
Logs[b]	1835	96.4	322.1	0	4135.7
Non-coniferous logs	1736	26.0	81.3	0	1116.3
Coniferous logs	1622	76.7	274.5	0	3209.6
Sawn wood	1955	298.1	924.7	0	9411.6
Non-coniferous sawn wood	1801	48.7	153.5	0	1618.8
Coniferous sawn wood	1819	272.2	898.0	0	9020.5
Plywood	1856	45.4	102.2	0	918.3
Veneer sheets	1657	27.3	64.5	0	533.0
Total[c]	1587	555.5	1302.2	0	10,265.4
ITTA					
1983 ITTA	1955	0.10	0.30	0	1
1994 ITTA	1955	0.15	0.36	0	1
Covariates					
Market potential	1955	11.55	6.23	1.42	34.88
GDP per capita	1955	11.32	10.92	0.12	56.29
GDP per capita^2	1955	247.33	393.25	0.01	3168.03
Population	1955	27.47	46.09	0.06	311.59
Year	1955	1995.07	11.33	1970	2011

[a]Exports' units are in millions US$

[b]Logs are represented by industrial roundwood

[c]Total = Logs + Sawn wood + Plywood + Veneer sheets

4 Data

All analysis in Sect. 5 is conducted separately on tropical and non-tropical countries. As described above, the ITTA treats member nations differently depending on this classification. As such, the effects of the ITTA are evaluated separately in order to allow for differing relationships between ITTA membership and exports depending on the different roles of ITTA members. Countries that are not member nations are classified according to the category of country the ITTA would consider them as and included in the appropriate control group. Appendix provides a list of tropical countries in Table A1 and a list of non-tropical countries in Table A2. The years of membership in the ITTAs are listed for each country in the same tables.[3] The following data are collected for both categories of countries.

4.1 ITTA participation and timber exports

ITTA participation data are recorded from the International Environmental Agreements Database Project (Mitchell 2013). Within this database, participation is coded as an indicator variable for each year and country, where the value "*X*" means membership and no "*X*" means no membership.

Timber export data are obtained from the Food and Agricultural Organization of the United Nations (FAO).[4] Export values are measured in millions of US dollars. As described above, the ITTA consider four specific categories of timber exports: logs, sawn wood, veneer sheets, and plywood (ITTO 1983). In accordance with this, the analysis focuses on these four categories as well.[5] Additional attention is paid to the difference in ITTA membership effect on coniferous and non-coniferous timber exports.[6] These exports are recorded separately by the FAO.

[3] Tropical countries are defined by the International Union for Conservation of Nature, who regard a nation as tropical if part or all of its landmass lies between the Tropic of Cancer and the Tropic of Capricorn (Davis et al. 1986).

[4] www.faostat3.fao.org/download/F/FT/E.

[5] For our purposes, logs are represented by industrial roundwood, that is "[All] roundwood except wood fuel. [It] is an aggregate comprising sawlogs and veneer logs; pulpwood, round and split; and other industrial roundwood. It is reported in cubic meters solid volume underbark (i.e., excluding bark). It excludes: telephone poles."

FAOSTAT-Forestry, Forest Products Definitions, document online: www.fao.org/forestry/34572-0fd5f2e523e4bc6251731c6101376d75e.pdf.

[6] Coniferous: "All woods derived from trees classified botanically as Gymnospermae, e.g., Abies spp., Araucaria spp., Cedrus spp., Chamaecyparis spp., Cupressus spp., Larix spp., Picea spp., Pinus spp., Thuja spp., Tsuga spp., etc."

These are generally referred to as softwoods.

Non-Coniferous: "All woods derived from trees classified botanically as Angiospermae, e.g., Acer spp., Dipterocarpus spp., Entandrophragma spp., Eucalyptus spp., Fagus spp., Populus spp., Quercus spp., Shorea spp., Swietonia spp., Tectona spp., etc."

These are generally referred to as broadleaves or hardwoods.

FAOSTAT-Forestry, Forest Products Definitions, document online: http://www.fao.org/forestry/34572-0fd5f2e523e4bc6251731c6101376d75e.pdf.

4.2 Covariates

Additional covariates in our empirical model include *Market Potential*, *Population*, *GDP per capita*, and *(GDP per capita)*^{2}.

Market potential is the distance weighted average of other countries' GDPs, where nearby countries receive a larger weight. This variable is constructed using the weight function $\omega = \frac{100}{\text{distance}}$. This calculation of market potential follows Head and Mayer (2004), Blonigen et al. (2007), and Blonigen et al. (2008). Real GDP (measured in millions of 2005 USD) data come from the United Nations' Statistics Division and distance (measured in kilometers) data from the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII 2012). Traditional thinking states that countries with large market potential tend to trade more.

Population (measured in thousands), from the United Nations' Department of Economic and Social Affairs, is included to control for the population pressures of a country on domestic natural resource demands. As stated in previous literature (Cropper and Griffiths 1994, p. 251) "population growth [...] increases the demand for wood, both for timber and for fuelwood." As population increases domestic demand, exports of timber are likely to fall.

To control for countries' income levels, the model includes *GDP per capita* and *(GDP per capita)*^{2} is constructed from the above data, where *GDP per capita* = $\frac{\text{Real GDP}}{\text{Population}}$ and

Table 2 Logs exports

Country type	(1) Tropical	(2) Tropical	(3) Non-tropical	(4) Non-tropical
Model	OLS	Tobit	OLS	Tobit
1983 ITTA	−0.923	2.829	−76.718***	−75.529***
	(13.162)	(10.744)	(22.418)	(15.428)
1994 ITTA	−27.808***	−26.907*	−108.844***	−100.434***
	(9.606)	(15.045)	(29.940)	(21.651)
Market potential	−19.422	−8.903	20.548	25.720*
	(22.050)	(24.481)	(13.940)	(14.032)
GDP per capita	−17.001***	−16.755**	28.267***	31.841***
	(4.696)	(6.679)	(7.271)	(7.128)
GDP per capita^2	0.290***	0.295**	−0.544***	−0.627***
	(0.085)	(0.140)	(0.136)	(0.130)
Population	−3.410*	−3.417**	−53.344***	−54.370***
	(1.872)	(1.670)	(10.336)	(4.015)
Constant	156.535	−48.909	15.308	6.490
	(115.997)	(170.545)	(103.219)	(151.843)
Observations	2417	2417	1835	1835
Censored at 0	255	255	183	183
R^2	0.730		0.911	

Year fixed effects, country fixed effects, and country-specific trend terms included. Robust standard errors in parentheses

*** $p<0.01$; ** $p<0.05$; * $p<0.1$

$(GDP\ per\ capita)^2 = \left(\frac{\text{Real GDP}}{\text{Population}}\right)^2$. In general, high-income countries tend to trade more, but that may not necessarily hold for narrowly defined trade sectors or natural resources such as timber.

The following analysis evaluates nine separate timber export categories: logs, non-coniferous logs, coniferous logs, sawn wood, non-coniferous sawn wood, coniferous sawn wood, veneer sheets, plywood and total exports.

5 Results

Results are presented for each type of timber export. Logs are presented in Table 2, non-coniferous logs in Table 3, coniferous logs in Table 4, sawn wood in Table 5, non-coniferous sawn wood in Table 6, coniferous sawn wood in Table 7, plywood in Table 8, veneer sheets in Table 9, and total exports in Table 10. In most of these tables, columns (1)–(2) represent tropical countries average effects and columns (3)–(4) non-tropical countries. Columns (1) and (3) use OLS estimation and columns (2) and (4) use Tobit.

Tables 7 and 8 include an additional column for the tropical sample. For these, the Tobit model did not converge for the full sample and the sample is restricted to countries with 20 or more years of data for each country. This sample allowed the Tobit model to converge.

All models presented include country fixed effects and country-specific trend terms. These regressions allow estimation of the effects of the 1983 and 1994 ITTAs, after

Table 3 Non-coniferous logs exports

Country type	(1) Tropical	(2) Tropical	(3) Non-tropical	(4) Non-tropical
Model	OLS	Tobit	OLS	Tobit
1983 ITTA	3.399	10.729	22.155***	21.031***
	(12.937)	(11.332)	(4.624)	(4.692)
1994 ITTA	−27.496***	−32.810**	25.042***	27.282***
	(9.321)	(15.639)	(7.614)	(6.420)
Market potential	−21.471	−7.026	−16.080***	−15.986***
	(24.080)	(26.735)	(4.370)	(4.187)
GDP per capita	−17.759***	−15.967**	−4.416**	−4.592**
	(5.711)	(7.537)	(1.819)	(2.154)
GDP per capita^2	0.266***	0.242*	0.086**	0.086**
	(0.098)	(0.147)	(0.035)	(0.039)
Population	−3.414*	−3.748**	4.542***	5.069***
	(1.869)	(1.696)	(1.413)	(1.198)
Constant	178.193	−129.267	96.389***	83.213*
	(120.165)	(197.880)	(30.432)	(47.657)
Observations	2311	2311	1736	1736
Censored at 0	281	281	184	184
R^2	0.733		0.882	

Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 4 Coniferous logs exports

Country type	(1) Tropical	(2) Tropical	(3) Non-tropical	(4) Non-tropical
Model	OLS	Tobit	OLS	Tobit
1983 ITTA	−10.109***	−13.717***	−102.041***	−101.271***
	(2.397)	(2.193)	(26.260)	(15.945)
1994 ITTA	−2.420	−5.096**	−137.702***	−133.782***
	(1.554)	(2.474)	(32.525)	(21.151)
Market potential	−1.507	1.238	38.187**	39.625***
	(2.413)	(3.526)	(16.182)	(14.335)
GDP per capita	−5.131***	−6.662***	35.781***	40.510***
	(1.560)	(1.494)	(8.032)	(7.192)
GDP per capita^2	0.125***	0.166***	−0.681***	−0.751***
	(0.033)	(0.029)	(0.158)	(0.130)
Population	−0.702**	−0.507	−62.018***	−63.273***
	(0.279)	(0.365)	(11.635)	(4.056)
Constant	1.555	−31.295	−78.076	−70.078
	(18.016)	(23.586)	(120.663)	(150.163)
Observations	1355	1355	1622	1622
Censored at 0	482	482	204	204
R^2	0.644		0.892	

Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

controlling for export trends of each country. The estimated models explain between 64 and 91 percent of variation in tropical countries' exports and between 88 and 94 percent of variation in non-tropical countries' exports. A significant portion of variation is explained by country fixed effects and country-specific trends. Yet, the partial effects of the 1983 and 1994 ITTAs are statistically significant in many of the estimated equations.

5.1 ITTA effects

Log exports overall fell for ITTA member countries for both tropical and non-tropical countries (Table 2). The ITTAs are particularly concerned with non-coniferous timber from tropical countries ITTO (1983). Accordingly, the non-coniferous log exports from tropical countries fell with the 1994 ITTA, reducing annual exports of tropical member countries by about $30 million on average (Table 3). Exports of non-coniferous logs from non-tropical countries, in contrast, increase by about $25 million in response to each of the ITTAs. This suggests the presence of substitution in exports between tropical and non-tropical ITTA member countries. ITTA participation decreases exports of coniferous logs for both tropical and non-tropical countries, with much larger effects on non-tropical countries (Table 4).

Sawn wood export regressions reveal increases from 1983 ITTA for non-tropical member countries (Table 5). Separate analysis of non-coniferous and coniferous sawn wood exports reveals this result is driven by coniferous sawn wood. In non-coniferous

Table 5 Sawn wood exports

Country type	(1) Tropical	(2) Tropical	(3) Non-tropical	(4) Non-tropical
Model	OLS	Tobit	OLS	Tobit
1983 ITTA	5.593	6.120	94.110**	106.221**
	(8.217)	(6.661)	(43.537)	(41.194)
1994 ITTA	−16.786**	−11.389	59.150	81.768
	(7.175)	(9.403)	(80.002)	(58.679)
Market potential	−11.360	−6.618	141.861**	125.432***
	(23.198)	(15.872)	(55.249)	(35.594)
GDP per capita	7.493**	8.911**	15.475	19.523
	(2.971)	(4.115)	(11.244)	(18.431)
GDP per capita^2	−0.262***	−0.285***	−0.556***	−0.581*
	(0.068)	(0.084)	(0.212)	(0.341)
Population	−0.129	−0.080	−31.964***	−39.834***
	(1.439)	(1.122)	(9.111)	(10.805)
Constant	51.493	−156.423	−890.749**	−747.283**
	(104.727)	(124.540)	(400.513)	(340.812)
Observations	2730	2730	1955	1955
Censored at 0	171	171	157	157
R^2	0.831		0.918	

Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

sawn wood, there is evidence the ITTAs have a small positive effect on exports for tropical and non-tropical countries (Table 6).

Table 7 again shows that there may be substitution between exports of tropical ITTA members and non-tropical members. Plywood exports from tropical countries increase as a consequence of the 1983 ITTA (Table 8) and non-tropical countries increased exports of veneer sheets specially as a consequence of the 1994 ITTA (Table 9). Tropical members' coniferous sawn wood exports decrease by about $14 million as a result of each of the ITTAs. In contrast, participation in the 1983 ITTA increases coniferous sawn wood exports from non-tropical countries by $83 million.

"Total exports" represents aggregated exports from the four timber categories of the ITTAs (logs, sawn wood, plywood and veneer sheets). For tropical countries, the 1983 ITTA increased total exports by $68 million for the average member country relative to non-members, after controlling for country-specific growth rates in exports and other covariates. This positive effect is in line with previous literature (Borsky et al. 2011). The estimated effects of ITTAs on total exports are statistically insignificant for non-tropical countries.

5.2 Covariate effects

Separate regressions for tropical and non-tropical countries allow the treaty effects and remaining coefficients to vary across the two samples. The expected relationship between trade and market potential is positive. For one tropical and seven non-tropical regressions,

Table 6 Non-coniferous sawn wood exports

Country type	(1) Tropical	(2) Tropical	(3) Non-tropical	(4) Non-tropical
Model	OLS	Tobit	OLS	Tobit
1983 ITTA	11.631	13.120**	15.659	17.172***
	(7.744)	(6.495)	(9.890)	(5.866)
1994 ITTA	−7.861	−1.564	18.103	20.336**
	(6.288)	(9.152)	(14.805)	(8.208)
Market potential	6.222	17.528	16.103**	13.962***
	(23.073)	(15.966)	(6.784)	(5.134)
GDP per capita	7.419***	7.424*	5.633**	6.516**
	(2.811)	(4.042)	(2.590)	(2.613)
GDP per capita^2	−0.258***	−0.321***	−0.086	−0.097**
	(0.066)	(0.084)	(0.054)	(0.048)
Population	−0.305	−0.221	−0.669	−1.523
	(1.313)	(1.080)	(3.399)	(1.506)
Constant	−33.983	−264.654**	−106.544**	−84.691*
	(101.304)	(122.432)	(44.309)	(48.364)
Observations	2642	2642	1801	1801
Censored at 0	210	230	155	155
R^2	0.830		0.943	

Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

the expected statistically significant coefficients on market potential are found. There is one negative statistically significant market potential coefficient for each sample. While it is difficult to interpret the negative market potential coefficients in two timber export category equations, for the generally more developed non-tropical countries, the market potential coefficients are consistently positive and statistically significant.

GDP per capita and its squared term are included to control for income in a nonlinear manner. In general, at least one of the GDP per capita variables is statistically significant and in most regressions, both terms are statistically significant. Given that the model incorporates country fixed effects and country-specific trend terms, interpreting the quadratic shape suggested by the estimates does not offer much insight.

Population coefficients with statistical significance are negative in most although not all equations. This expected negative effect is in accord with population increasing domestic demand for timber (among other natural resources) and thereby reducing exports. The coefficient on population is positive and statistically significant in the tropical country regression for plywood exports and non-tropical countries' exports of veneer sheets. Since plywood and veneer sheets are somewhat more labor intensive, an increase in population would likely result in an increase in labor force availability and an increase production in labor-intensive industries.

Table 7 Coniferous sawn wood exports

Country type	(1) Tropical	(2) Tropical	(3) Tropical	(4) Non-tropical	(5) Non-tropical
Model	OLS	OLS[a]	Tobit[a]	OLS	Tobit
1983 ITTA	−14.102***	−14.417***	−13.886***	82.654**	84.267**
	(4.014)	(4.191)	(3.604)	(39.481)	(41.993)
1994 ITTA	−14.211***	−15.095***	−15.995***	46.879	74.440
	(4.323)	(4.852)	(4.437)	(73.271)	(59.167)
Market potential	−19.059***	−26.037***	−26.087***	130.928**	112.902***
	(5.166)	(6.942)	(7.607)	(55.474)	(37.294)
GDP per capita	−1.950	−2.678	−2.314	9.644	12.308
	(1.552)	(1.792)	(2.162)	(10.811)	(19.001)
GDP per capita^2	0.018	0.025	0.017	−0.435**	−0.486
	(0.027)	(0.030)	(0.039)	(0.185)	(0.348)
Population	0.782	0.903	1.012	−34.980***	−38.242***
	(0.948)	(0.978)	(0.802)	(8.482)	(11.263)
Constant	88.243**	69.107***	41.469*	−985.461**	−854.746*
	(37.154)	(20.024)	(24.298)	(422.007)	(436.443)
Observations	1802	1175	1175	1819	1819
Censored at 0	406	133	133	195	195
R^2	0.861	0.858		0.916	

Tobit did not converge for the full sample. Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

[a]Columns (2) and (3) only include countries with 20 or more observations.

6 Conclusion

The ITTAs were designed to promote both international trade and environmental sustainability. Although these two topics are highly interconnected, previous research has yet to reach a conclusion on how they affect each other. Conventional wisdom suggests international trade leads to concentrated poor environmental quality in certain regions and that environmental standards lead to less competitiveness. By merging a trade agreement and an IEA, the ITTAs attempt to increase environmental sustainability worldwide, without decreasing any individual country's trade competitiveness. This study analyzes whether the 1983 and 1994 ITTAs affected timber exports for member countries, in order to evaluate whether the agreements were effective at maintaining trade competitiveness.

We use panel data for 95 tropical and 70 non-tropical countries to examine the impact of the first two ITTAs on timber exports. OLS and Tobit estimation procedures are used with country fixed effects, year fixed effects and country-specific growth trends. Our analysis is limited to those timber categories specifically mentioned in the ITTA documents themselves (logs, sawn wood, veneer sheets and plywood).

There is slight evidence of substitution between tropical and non-tropical countries. For non-coniferous logs tropical countries reduced their exports, while non-tropical countries increased exports in response to the ITTAs. This suggests that the global demand for non-coniferous logs was cleared by an increased supply of these types of logs from member

Table 8 Plywood exports

Country type	(1) Tropical	(2) Tropical	(3) Tropical	(4) Non-tropical	(5) Non-tropical
Model	OLS	OLS[a]	Tobit[a]	OLS	Tobit
1983 ITTA	71.557***	71.985***	81.401***	−5.897	−6.398
	(21.193)	(21.065)	(23.811)	(6.110)	(4.866)
1994 ITTA	−3.232	−3.603	19.913	−9.688	−6.008
	(21.436)	(22.672)	(34.976)	(9.176)	(6.880)
Market potential	72.108*	93.233**	114.945*	27.209***	28.359***
	(37.339)	(45.120)	(66.892)	(6.322)	(4.274)
GDP per capita	46.867***	52.190***	61.167***	5.582**	5.715***
	(10.073)	(11.471)	(18.868)	(2.417)	(2.194)
GDP per capita^2	−0.809***	−0.874***	−1.007***	−0.126***	−0.131***
	(0.161)	(0.177)	(0.340)	(0.043)	(0.040)
Population	22.727***	22.652***	24.537***	−6.140***	−6.178***
	(7.273)	(7.232)	(3.673)	(1.776)	(1.295)
Constant	−860.474***	−964.327***	−1455.884***	−141.063***	−117.965**
	(256.302)	(289.139)	(423.452)	(39.077)	(50.653)
Observations	2049	1595	1595	1856	1856
Censored at 0	290	155	155	218	218
R^2	0.788	0.786		0.913	

[a]Columns (2) and (3) only include countries with 20 or more observations. Tobit did not converge for the full sample. Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

countries that were not tasked with increasing sustainability. While the environmental sustainability commandment applied to a large majority of tropical countries, non-tropical countries, even those participating in the ITTA, were not encouraged to develop the same practices. As a result, non-tropical non-coniferous logs may have been more competitive in the international market. A similar pattern emerges for coniferous sawn wood, where tropical countries decrease exports as a result of ITTA membership and non-tropical countries increase exports.

The estimation results suggest countries substitute between timber export categories. Both tropical and non-tropical countries reduced total logs exports in response to one or two of the ITTAs but in response they increased exports of higher-value timber. Non-tropical countries increased veneer sheets exports, while tropical countries increased plywood exports. Recall objective (e) of the ITTA called for "further processing of tropical timber in producer member countries" (ITTO 1983). These results suggest this objective was satisfied.

Overall, the 1983 ITTA appears to increase targeted timber exports from tropical member countries. These countries were especially subject to the environmental sustainability goals written into the ITTA. This suggests that it is possible for an international agreement to promote both trade and environmental sustainability. This result is important for future policy that seeks to develop international environmental cooperation. Both goals are achievable simultaneously. Furthermore, an incentive of increased trade could draw

Table 9 Veneer sheets exports

Country type Model	(1) Tropical OLS	(2) Tropical Tobit	(3) Non-tropical OLS	(4) Non-tropical Tobit
1983 ITTA	1.793	2.646	4.906	4.747*
	(1.910)	(2.059)	(3.214)	(2.787)
1994 ITTA	1.613	0.814	13.599***	12.815***
	(2.286)	(2.816)	(4.409)	(3.817)
Market potential	−0.192	0.163	11.961***	11.806***
	(4.888)	(5.081)	(3.487)	(2.451)
GDP per capita	2.055*	2.341*	3.482***	3.447***
	(1.223)	(1.261)	(1.071)	(1.260)
GDP per capita^2	−0.039**	−0.066***	−0.052***	−0.049**
	(0.018)	(0.024)	(0.019)	(0.023)
Population	−0.021	0.096	4.989***	4.884***
	(0.149)	(0.294)	(1.242)	(0.715)
Constant	−7.752	−51.788	−83.534***	−69.809***
	(22.906)	(33.625)	(23.945)	(19.670)
Observations	1784	1784	1657	1657
Censored at 0	308	308	190	190
R^2	0.757		0.936	

Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

previously uncooperative countries to IEAs, although a caveat worth mentioning here is that sustainability goals became better defined in the 1994 ITTA, and for that agreement we did not find the positive effect on member countries' exports.

This analysis agrees with Borsky et al. (2011). Further research should analyze the environmental impacts of the ITTA. The result of increased trade has been shown, but research must confirm that the environmental objectives were also satisfied. More broadly, further analysis should consider if this relationship holds for other natural resources and environmental quality objectives.

Table 10 Total exports

Country type	(1) Tropical	(2) Tropical	(3) Non-tropical	(4) Non-tropical
Model	OLS	Tobit	OLS	Tobit
1983 ITTA	68.161*	66.575**	20.262	17.958
	(35.871)	(31.482)	(69.431)	(58.426)
1994 ITTA	−28.732	−19.958	−47.012	−28.795
	(26.688)	(39.392)	(104.486)	(77.580)
Market potential	10.671	28.908	232.231***	233.430***
	(77.053)	(71.792)	(79.709)	(51.038)
GDP per capita	11.613	11.956	65.190***	63.417**
	(16.258)	(21.143)	(19.595)	(26.157)
GDP per capita^2	−0.530*	−0.532	−1.406***	−1.380***
	(0.278)	(0.377)	(0.335)	(0.468)
Population	6.260	6.109	−98.607***	−102.231***
	(4.048)	(4.110)	(21.904)	(14.675)
Constant	−296.787	−940.487**	−1500.151**	−1521.471***
	(369.796)	(473.294)	(608.370)	(570.608)
Observations	1504	1504	1587	1587
Censored at 0	17	17	33	33
R^2	0.908		0.929	

Year fixed effects, country fixed effects and country-specific trend terms included. Robust standard errors in parentheses

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Appendix

Sample of countries

Table A1 Tropical countries in the sample

	Country	# Years	Min (Year)	Max (Year)	ITTA83	ITTA94
1	Algeria	19	1992	2011	0	0
2	Angola	26	1985	2011	0	0
3	Antigua and Barbuda	20	1992	2011	0	0
4	Argentina	39	1972	2011	0	0
5	Australia[a]	42	1970	2011	1	1
6	Bahamas	21	1987	2011	0	0
7	Bangladesh	20	1992	2011	0	0
8	Barbados	19	1987	2009	0	0
9	Belize	42	1970	2011	0	0
10	Benin	21	1987	2011	0	0
11	Bolivia	42	1970	2011	1	1
12	Botswana	3	2009	2011	0	0
13	Brazil	42	1970	2011	1	1

Table A1 continued

	Country	# Years	Min (Year)	Max (Year)	ITTA83	ITTA94
14	Brunei Darussalam	37	1974	2011	0	0
15	Burkina Faso	20	1987	2011	0	0
16	Burundi	19	1992	2011	0	0
17	Cambodia	19	1993	2011	0	1
18	Cameroon	42	1970	2011	1	1
19	Central African Republic	42	1970	2011	0	1
20	Chad	11	2001	2011	0	0
21	Chile	42	1970	2011	0	0
22	Colombia	42	1970	2011	1	1
23	Congo	42	1970	2011	1	1
24	Costa Rica	41	1970	2011	0	0
25	Cuba	18	1993	2010	0	0
26	Djibouti	18	1992	2009	0	0
27	Dominica	19	1992	2011	0	0
28	Dominican Republic	21	1987	2011	0	0
29	Ecuador	42	1970	2011	1	1
30	Egypt[a]	20	1992	2011	1	1
31	El Salvador	20	1992	2011	0	0
32	Equatorial Guinea	27	1985	2011	0	0
33	Eritrea	10	2002	2011	0	0
34	Fiji	42	1970	2011	0	1
35	French Polynesia	9	1992	2000	0	0
36	Gabon	42	1970	2011	1	1
37	Gambia	20	1992	2011	0	0
38	Ghana	42	1970	2011	1	1
39	Guatemala	42	1970	2011	0	1
40	Guinea	21	1987	2011	0	0
41	Guinea-Bissau	42	1970	2011	0	0
42	Guyana	41	1970	2010	1	1
43	Haiti	18	1994	2011	0	0
44	Honduras	42	1970	2011	1	1
45	India	42	1970	2011	1	1
46	Indonesia	42	1970	2011	1	1
47	Ivory Coast	42	1970	2011	1	1
48	Jamaica	22	1970	2001	0	0
49	Kenya	42	1970	2011	0	0
50	Lao People's Democratic Rep.	28	1984	2011	0	0
51	Liberia	38	1970	2011	1	1
52	Libya	11	1999	2009	0	0
53	Madagascar	36	1970	2011	0	0
54	Malawi	31	1970	2011	0	0
55	Malaysia	42	1970	2011	1	1
56	Mali	20	1992	2011	0	0

Table A1 continued

	Country	# Years	Min (Year)	Max (Year)	ITTA83	ITTA94
57	Mauritania	19	1992	2011	0	0
58	Mauritius	20	1992	2011	0	0
59	Mexico	42	1970	2011	0	1
60	Mozambique	32	1980	2011	0	0
61	Namibia	12	2000	2011	0	0
62	New Caledonia	8	1992	2000	0	0
63	Nicaragua	42	1970	2011	0	0
64	Niger	20	1992	2011	0	0
65	Nigeria	42	1970	2011	0	1
66	Oman	20	1992	2011	0	0
67	Panama	25	1974	2011	1	1
68	Papua New Guinea	42	1970	2011	1	1
69	Paraguay	42	1970	2011	0	0
70	Peru	42	1970	2011	1	1
71	Philippines	42	1970	2011	1	1
72	Rwanda	19	1992	2011	0	0
73	Saint Kitts and Nevis	19	1993	2011	0	0
74	Samoa	29	1982	2011	0	0
75	Saudi Arabia	20	1992	2011	0	0
76	Senegal	20	1992	2011	0	0
77	Seychelles	20	1992	2011	0	0
78	Sierra Leone	29	1983	2011	0	0
79	Singapore	42	1970	2011	0	0
80	Solomon Islands	22	1990	2011	0	0
81	Sri Lanka	33	1970	2011	0	0
82	Suriname	36	1975	2010	0	1
83	Thailand	42	1970	2011	1	1
84	Timor-Leste	6	2006	2011	0	0
85	Togo	25	1970	2011	1	1
86	Tonga	15	1997	2011	0	0
87	Trinidad and Tobago	40	1970	2011	1	1
88	Uganda	20	1987	2011	0	0
89	United Arab Emirates	20	1992	2011	0	0
90	Vanuatu	33	1979	2011	0	1
91	Venezuela	21	1987	2011	0	1
92	Viet Nam	24	1988	2011	0	0
93	Yemen	19	1992	2011	0	0
94	Zambia	25	1970	2011	0	0
95	Zimbabwe	36	1976	2011	0	0

[a]Australia and Egypt are tropical countries, but are designated as "consumer" by the ITTO

Table A2 Non-tropical countries in the sample

	Country	# Years	Min (Year)	Max (Year)	ITTA83	ITTA94
1	Albania	25	1987	2011	0	0
2	Andorra	17	1992	2008	0	0
3	Armenia	20	1992	2011	0	0
4	Austria	42	1970	2011	1	1
5	Azerbaijan	20	1992	2011	0	0
6	Bahrain	19	1987	2010	0	0
7	Belarus	20	1992	2011	0	0
8	Bhutan	30	1980	2011	0	0
9	Bosnia and Herzegovina	18	1994	2011	0	0
10	Bulgaria	32	1980	2011	0	0
11	Canada	42	1970	2011	1	1
12	Croatia	17	1995	2011	0	0
13	Cyprus	33	1975	2011	0	0
14	Czech Republic	19	1993	2011	0	0
15	Denmark	42	1970	2011	1	1
16	Estonia	17	1995	2011	0	0
17	Finland	42	1970	2011	1	1
18	France	42	1970	2011	1	1
19	Georgia	19	1993	2011	0	0
20	Germany	42	1970	2011	0	1
21	Greece	42	1970	2011	1	1
22	Greenland	16	1994	2009	0	0
23	Hungary	42	1970	2011	0	0
24	Iceland	20	1992	2011	0	0
25	Iran	29	1970	2009	0	0
26	Ireland	42	1970	2011	1	1
27	Israel	20	1992	2011	0	0
28	Italy	42	1970	2011	1	1
29	Japan	42	1970	2011	1	1
30	Jordan	19	1993	2011	0	0
31	Kazakhstan	20	1992	2011	0	0
32	Kuwait	17	1995	2011	0	0
33	Kyrgyzstan	20	1992	2011	0	0
34	Latvia	20	1992	2011	0	0
35	Lebanon	23	1988	2011	0	0
36	Lesotho	3	2009	2011	0	0
37	Lithuania	20	1992	2011	0	0
38	Luxembourg	12	2000	2011	0	1
39	Malta	20	1992	2011	0	0
40	Mongolia	30	1981	2011	0	0
41	Morocco	20	1992	2011	0	0
42	Nepal	27	1970	2011	1	1
43	Netherlands	42	1970	2011	1	1

Table A2 continued

	Country	# Years	Min (Year)	Max (Year)	ITTA83	ITTA94
44	New Zealand	35	1977	2011	1	1
45	Norway	42	1970	2011	1	1
46	Pakistan	21	1987	2011	0	0
47	Poland	22	1990	2011	0	1
48	Portugal	42	1970	2011	1	1
49	Qatar	12	2000	2011	0	0
50	Republic of Korea	42	1970	2011	0	0
51	Republic of Moldova	20	1992	2011	0	0
52	Romania	32	1980	2011	0	0
53	Russian Federation	20	1992	2011	0	0
54	Slovakia	19	1993	2011	0	0
55	Slovenia	20	1992	2011	0	0
56	South Africa	42	1970	2011	0	0
57	Spain	42	1970	2011	1	1
58	Swaziland	40	1970	2011	0	0
59	Sweden	42	1970	2011	1	1
60	Switzerland	32	1980	2011	1	1
61	Syrian Arab Republic	31	1970	2010	0	0
62	Tajikistan	19	1993	2011	0	0
63	Tunisia	22	1975	2011	0	0
64	Turkey	42	1970	2011	0	0
65	Turkmenistan	18	1994	2011	0	0
66	Ukraine	20	1992	2011	0	0
67	United Kingdom	42	1970	2011	1	1
68	United States	42	1970	2011	0	1
69	Uruguay	30	1970	2011	0	0
70	Uzbekistan	18	1994	2011	0	0

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