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Who Gets What from IOs? The Case of the International Atomic Energy Agency's Technical Cooperation

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Abstract

What affects the allocation of aid by international organizations to their member states? Using data on nuclear assistance by the International Atomic Energy Agency (IAEA), I demonstrate that political considerations affect the likelihood of receiving aid, and the amount of aid countries receive. Specifically, I find that membership in the IAEA Board of Governors or acceptance of tougher IAEA inspections increase the likelihood of IAEA assistance, and in some cases the amounts of assistance, but only for countries that do not share policy preferences with the US. This finding is consistent with theories that foreign aid is given in exchange for cooperation and concessions to recipients that are not likely to be cooperative without aid. I also examine whether nuclear assistance is given to countries that need it the most and that can make effective use of this aid, and find only partial support for need-based explanations of aid allocation.

Introduction

Which countries are more likely to apply for and receive aid from international organizations (IOs), and what accounts for the amount of aid they receive and the areas in which they receive assistance? Existing studies highlight the role of various political and need-based factors. In this paper, I evaluate these explanations in the context of the International Atomic Energy Agency (IAEA or the Agency). I examine the IAEA Technical Cooperation (TC) program through which the Agency delivers assistance to its member states in the application for nuclear technologies for peaceful purposes. As part of the TC, the IAEA provides or pays for training, expert advice, or equipment in member states in order to build, strengthen, and maintain their capacity to use nuclear technologies in areas such as medicine, agriculture, energy, water, and basic sciences. Participation rate in TC is very high, with about 80% of member states receiving some form of assistance every year. Using data on the allocation of IAEA TC assistance between 2000 and 2004, I find that countries that do not share policy preferences with the US become more likely to receive aid from the

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IAEA, and receive more assistance, when they serve in influential positions in the Agency or make policy concessions related to nuclear nonproliferation. Furthermore, while TC recipients' economic performance is related to distribution of TC aid, it has a differential effect on the likelihood of assistance, its amounts, and the area of assistance.

The IAEA is a United Nations (UN)-affiliated agency that focuses on promoting safe, secure, and peaceful applications of nuclear technologies. Currently, over 160 countries are members of the IAEA.[1] In addition to promoting the peaceful uses of nuclear energy through the TC program, which is the focus of this paper, the IAEA plays a key role in two additional areas: nuclear verification and safety. The IAEA performs nuclear inspections to verify states' compliance with their international obligations, such as the commitment under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) to use nuclear materials only for peaceful purposes. The IAEA is also considered to be the international authority on nuclear safety and security, it drafts recommendations on issues such as nuclear and radiological emergencies, and serves as the depositary of key international nuclear safety and security conventions.

The TC program is not unique to the IAEA, and many UN specialized agencies and organizations operate similar programs designed to transfer knowledge and build member states' capacity.[2] Previous studies conducted mostly in the context of the International Monetary Fund (IMF), the World Bank, and the World Trade Organization (WTO) provide several explanations for how IOs allocate resources to their members. According to one approach, IOs assist states who need it the most, and can use these resources effectively in order to advance the declared goals of the assistance (needs-driven explanation) (Bird and Rowlands, 2001; Willett, 2002). Other views highlight political considerations that affect the allocation of aid, such as the recipients' proximity to the US (Benvenisti and Downs, 2005; Stone, 2008; Vreeland, 2005), their position within the organization (Bueno de Mesquita and Smith, 2010; Dreher, Sturm and Vreeland, 2006) and concessions-for-aid exchange (Urpelainen, 2012). My findings based on data from the IAEA offer evidence for some of these explanations, and also suggest that they may interact in so far under-explored ways. First, some aspects of the IAEA TC are need-driven – for example, countries with lower GDP are more likely to receive agriculture- and health-related assistance. However, other types of aid, in particular assistance in the nuclear fuel-cycle area, are given to relatively well-off members. Moreover, political factors – proximity to the US, country's position within the IO, and policy concessions matter, and their effects are conditional on each other. Specifically, countries that do not share policy preferences with the US become

[1] The latest list of members is available here: https://www.iaea.org/about/governance/list-of-member-states.

[2] The list of all UN-affiliated agencies and organizations is available here: http://www.un.org/depts/los/Links/UN-links.htm. The websites of these organizations suggest that all of them operate some sort of technical cooperation program.

more likely to receive TC, and receive larger amounts, when they serve on the IAEA Board of Governors (BOG), which is the key decision-making body of the Agency, or after they make significant concessions in the area of nuclear nonproliferation.

There are several advantages to focusing on the IAEA. First, the Agency plays an important role in several cases of political importance to the US, among them the Iranian nuclear issue. Thus, if resources are used to elicit cooperation from countries that do not share the US preferences, it should be evident in the case of the IAEA. Second, there are extensive data on annual allocation of the IAEA TC starting from 2004, including which countries receive assistance, as well as the amounts and the type of assistance that they receive. Finally, there is also the advantage of focusing on a single IO because comparisons across organizations are problematic given the underlying differences among them. This also means, however, that the findings presented here are based on evidence from this particular organization, and that other IOs may distribute their resources differently.

This analysis has several implications. First, my findings complement recent studies of nuclear cooperation (Fuhrmann, 2009*a*,*b*; Kroenig, 2009*a*,*b*) by illuminating the determinants of nuclear assistance and expanding the analysis beyond the interstate bilateral context to the IAEA. Similarly to these studies, I find support for the argument that strategic interests shape the allocation of nuclear assistance. Furthermore, several recent studies raise the concern that civilian nuclear cooperation, including the assistance provided by the IAEA, may contribute to nuclear proliferation (Brown and Kaplow, 2014; Fuhrmann, 2009*a*). This prospect highlights the importance of understanding which countries receive such assistance in the first place, and this paper provides such analysis. Importantly, my findings offer some reassurance, at least regarding the IAEA TC: I show that agreeing to tighter nonproliferation inspections by potential TC recipients moderates the effect of other political factors (shared interests with the US) on the likelihood and the amount of assistance.

I proceed as follows. First, I present the background on the IAEA and its TC program. Then, I review previous studies and outline hypotheses about the determinants of TC allocation. Next, I briefly discuss the data and the empirical strategy, and present the results of the analysis. I conclude by summarizing the main argument and findings, and pointing out several implications of this analysis.

The IAEA and Technical Cooperation

Background on the IAEA

The IAEA is a UN-affiliated international organization established in 1957 as part of the Atoms for Peace Initiative. The Agency is governed by two bodies: the General Conference (GC) of all member states, and the Board of Governors (BOG, or the Board) that is considered to be the most important decision-making body of the Agency.[3] The Agency has a staff of over 2,500 employees and it is headed by an elected Director General.[4]

The BOG is composed of thirty five members, twelve of which are designated, and the remaining twenty three are elected to serve for a period of two years (Scheinman, 1987, 82-83). The twelve designated countries are considered to be the most advanced in the nuclear field, globally or regionally (IAEA, 1956, Article IV.A.1): Canada, China, France, Russia, UK, US, Argentina or Brazil, South Africa, Japan, India, Australia, and one European (usually Scandinavian) country – Denmark, Finland, Norway or Sweden (Fischer, 1997, 39-40). Most of them always serve on the Board. The other twenty three members are elected by the GC based on quotas allocated for regional groups, and they serve for two years.

In recent years, the IAEA and the BOG have become key players in the international debates surrounding the Iranian nuclear program. Between 2003 and 2012, the Board has adopted twelve resolutions on the matter, and has referred it to the United Nations Security Council (UNSC) that has subsequently imposed sanctions against Iran. Despite the initial unanimity, since September 2005 BOG resolutions on Iran were adopted by a majority vote due to the growing disagreements among the Board members on this issue.

The Agency's Statute authorizes it to promote and facilitate peaceful uses of nuclear energy by supplying materials, services, equipment, and facilities to its member states, "with due consideration for the needs of the under-developed areas of the world" (IAEA, 1956, Article III.A.2). TC program is the main vehicle through which the IAEA distributes aid to its members. The IAEA also plays a key role of inspecting nuclear activities within member states, to make sure they comply with their nonproliferation commitments and do not develop nuclear weapons. In particular, the IAEA monitors compliance with the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). The TC and the nuclear verification are the central pillars of the IAEA, and this is also reflected in the distribution of resources between these two programs. In addition,

[3]The BOG "makes recommendations to the General Conference on the IAEA's accounts, program, and budget and considers applications for membership. It also approves safeguards agreements and the publication of the IAEA's safety standards and has the responsibility for appointing the Director General of the IAEA with the approval of the General Conference", http://www.iaea.org/About/Policy/Board/.

[4]IAEA website, http://www.iaea.org/About/staff.html

the IAEA also serves as the international authority on the safe use of nuclear and radioactive materials, drafts recommendations for safety standards and procedures of response to emergencies, and also serves as the depositary of key international conventions in nuclear safety and security.

IAEA member states hold different views about the right balance between the IAEA's regulatory and monitoring role, and its mandate to promote the use of nuclear energy (Findlay, 2012, 86-87), (Fischer, 1997, 325-328; 335), (Scheinman, 1987, 246). The developing countries attach high importance to TC, and view it as a form of developmental assistance. Conversely, the developed countries view TC assistance as a benefit given to the developing countries in exchange for allowing the IAEA to focus on the implementation of nuclear safeguards and nuclear safety and security. One of the key recent initiatives designed to strengthen the IAEA verification capacity is the Additional Protocol (AP) that supplements states' IAEA safeguard agreements (IAEA, 1997). Unlike the existing agreements that focus on verification of declared materials, the AP enables the IAEA to provide assurances about both declared and undeclared materials by expanding the Agency's inspectors' access rights to information and sites (Findlay, 2012, 62-63). The US has been one of the strongest supporters of the AP, as part of the US emphasis on strengthening the IAEA safeguards to prevent nuclear proliferation. Member states can choose whether to join the AP, but once they do, it becomes legally binding. As of June 2016, one hundred twenty six member states have joined the AP, and twenty others have signed but have yet to ratify it.

Although joining the AP is not a condition for receiving TC assistance, the IAEA and the developed countries seeking to strengthen nuclear safeguards view TC as a means to encourage participation in the AP, especially among developing countries that are in need of TC assistance. Such countries are more likely to accept additional nonproliferation obligations if they believe the IAEA would also address their developmental needs (Hibbs, 2013). A concrete recent example of the connection between TC and nonproliferation is the IAEA's denial in 2006 of Iran's request for safety-related assistance to its nuclear research reactor due to nonproliferation concerns (Landler, 2006). In 2015, Iran has reached an agreement with the five permanent UNSC members, Germany and the EU. As part of this deal, Iran has agreed to implement the AP (The White House, 2015). Following this declaration, Iran has requested the IAEA to renew TC assistance to Iran (Tehran Times Political Desk, 2016). The Iranian case suggests that there may be a linkage between recipients' nonproliferation commitments and the allocation of TC resources, whereby accepting nonproliferation commitments is viewed by the Agency and by the influential members (for example, the US as well as other developed countries) as a positive sign that would allow states to request TC on the basis of their nonproliferation behavior.

Overview of the IAEA TC program

The IAEA TC program is sustained through member states' voluntary contributions to the TC Fund (TCF). The expected contribution is based on the UN assessment rate.[5] The developed countries are the primary donors to the TCF, with the US being the largest donor (25% of TCF budget in 2004-2012), followed by Japan (16%), Germany (8%), UK (6%), Italy (5%), Canada (3%), Spain (3%), China (2%), and South Korea (2%).

Some projects are also funded using extra-budgetary sources such as government cost-sharing, donations, and the United Nations Development Program (UNDP) funds, though most of national projects rely on the TCF (see Table 1).

Table 1: TC amounts, 2004-2012

Year	Total amount disbursed	TC funds disbursed	# countries that receive TC
2004	48,972,584	42,576,852	104
2005	50,464,676	43,783,588	108
2006	63,445,580	52,854,632	112
2007	60,630,092	50,875,052	114
2008	64,442,728	54,405,960	115
2009	51,833,700	43,111,400	117
2010	68,315,944	52,964,952	119
2011	45,716,976	33,914,752	114
2012	45,421,344	36,126,604	119

The amounts are in $US adjusted for inflation, 2009 is the base year.
Only national disbursements are included; regional projects are excluded.
Source: IAEA TC Annual Reports (multiple years)

Figure 1 depicts TC amounts allocation to country-years for the 2004-2012 period. The mean annual allocation is $403,457 per country-year, and the median allocation is $346,741 (both figures in 2009 $US). As shown in Figure 1, almost 30% of all country-years receive nothing or very small amounts. About 20% of the IAEA members do not receive any TC during the years studied here. Most of the disbursements are below 1 million $US per country-year, with some outliers in the 1-2 million range (for example, 1.9 million $US to Poland in 2005).

TC projects provide support in various areas, such as agriculture, human health and pharmaceuticals, food supply, monitoring and managing of water resources, industrial applications, energy and nuclear power, radiation protection, nuclear safety and security, as well as basic sciences. For example, the IAEA provides assistance in applying nuclear technologies for pest control in agriculture, training of health workers to

[5] http://www.un.org/en/ga/contributions/budget.shtml

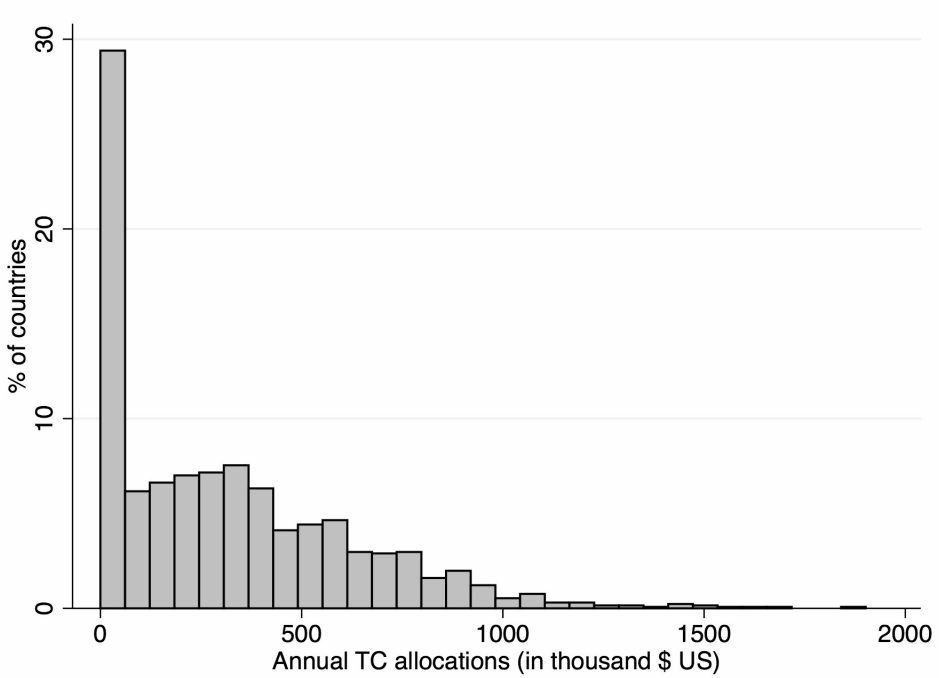

Figure 1: TC amounts to country-years during 2004-2012 period

apply radioactive materials for diagnostics and treatment, and the use of radioactive isotopes to manage groundwater and aquifers.[6] IAEA TC assists by transferring equipment, providing expert services, training, fellowships, and scientific visits. With respect to the latter, the IAEA pays for and arranges visits by senior scientists in IAEA laboratories, or in national facilities of one of the members states. TC is provided to various entities, such as national nuclear authorities, other government bodies, hospitals, nuclear power plants operators, as well as individual scientists.

Application to and approval of IAEA assistance

All IAEA members are entitled to apply for TC. Countries interested in assistance submit proposals through their official representatives in the IAEA headquarters. Figure 2 depicts the process of TC approval. Proposals include a work plan and a timetable; identify the amount of money or the specific assistance that the IAEA is requested to provide; explain how the particular projects fits into a national program, and whether the government supports promoting the goal behind the project; and justify why nuclear technology is the best way to pursue the project's goals, and whether the requesting country has the necessary safety and

[6] Additional information and examples of TC projects are available on the IAEA TC website, https://www.iaea.org/technicalcooperation/areas-of-work/index.html.

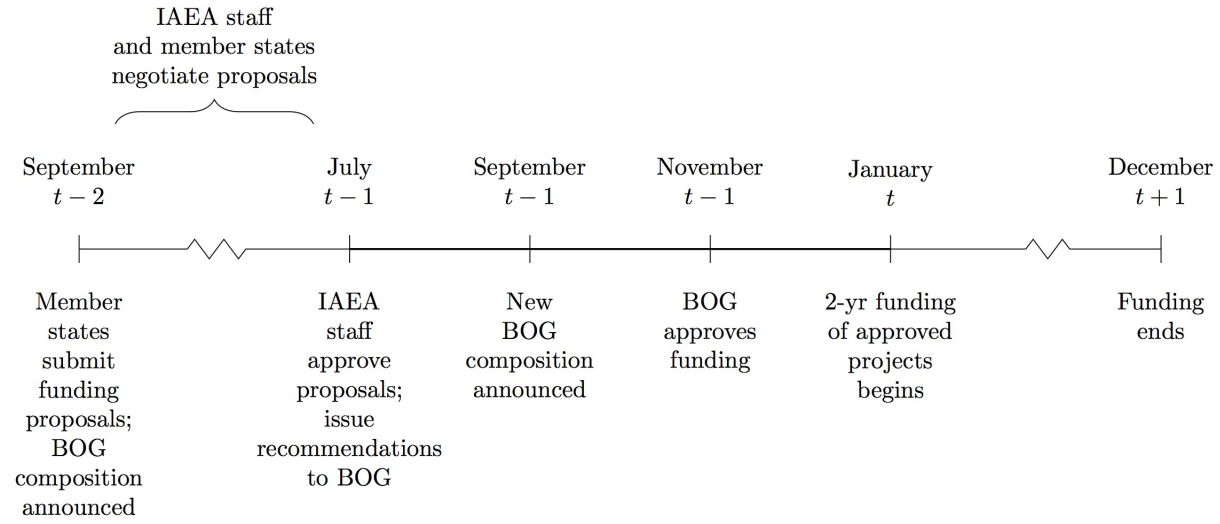

Figure 2: A typical timeline of IAEA TC funding approval

security arrangements in place to implement the project (IAEA, 2011). The IAEA TC staff reviews the proposals, and returns them with comments to the submitting countries. After several rounds of comments, revisions and resubmissions, the IAEA TC makes recommendation to the Board, which is the final authority that approves funding.[7]

The IAEA applies several criteria to assess applications. First, nonproliferation concerns may affect TC assistance, even though currently there is no formal linkage between the applicant's nonproliferation record and the right to receive TC.[8] Second, in projects that involve the use of nuclear materials, the IAEA assesses whether the applicant's nuclear safety infrastructure is adequate for the proposed activity.[9]

Third, the IAEA is more likely to support proposals that are in line with the national development goals as defined by the applicant's government, and that enjoy a strong government backing. In addition, proposals that demonstrate that nuclear technologies are necessary to achieve these national goals, and that there are high chances of success are more likely to be approved (IAEA, 2002). These criteria suggest that better governing capacity should be associated with a higher likelihood of IAEA TC allocation.

Fourth, countries that concluded the Revised Supplementary Agreement (RSA) Concerning the Provision of Technical Assistance by the IAEA are more likely to participate in TC projects, although some receive assistance without such an agreement (EU, 2012, see point 5).[10]

[7] For the most current timeline of TC approval see Longoria (2013, slide 9) and IAEA (2011, 8).
[8] Email exchange with a nuclear nonproliferation expert, March 2016.
[9] Email correspondence with the IAEA Press and Public Information officer, March 2016.
[10] By concluding the RSA, a member state agrees that TC projects are subject, if needed, to the safeguards provisions. The RSA also contains provisions on safety standards, peaceful use undertaking, physical protection, and the transfer of title to

Finally, the IAEA provides preferential allocation of TC assistance to member states with a good record of financial support for the TC fund (IAEA, 2007). Even though contributions to TCF are voluntary, countries that do not pay their expected share are likely to receive lower amounts of assistance from the fund. This factor affects primarily the levels of TC assistance (Aning, 2014).

Even though all the IAEA members are eligible to apply for TC, in practice not all countries receive assistance. For example, between 2004 and 2012, about 20% of member states did not receive any TC. Some countries may not apply every year, while others may not apply at all. In some cases, the Agency may also refuse to provide assistance, as it happened in the case of Iran in 2006 (Landler, 2006). The publicly-available data on the IAEA TC allocation provides information only on those countries that receive assistance, but not those that are declined, or those that do not apply for TC. The set of non-recipients includes countries that do not request TC as well as countries whose applications for assistance the Agency denied. Although there is no data that allows us to distinguish between these cases, it is known that most of the developed high-income countries do not apply for TC, and participate only as TCF donors (Fischer, 1997, 348-349). Indeed, Table A1 in the supporting material shows that most of the Agency's members that do not receive any TC in this period are developed countries. Nevertheless, dropping all the developed countries from the analysis is not a solution because some developed countries receive TC in non-negligible amounts. For example, South Korea, Greece, the Czech Republic, Hungary, Portugal, Poland, as well as all countries in Latin America are among TC recipients during the years that this paper focuses on (2004-2012). In this group, Poland and Brazil are among the top ten recipients of TC. This suggests that TC recipients vary in the extent of their economic development, their geographic location, and political preferences. Nonetheless, the unavailability of data on TC requests and denials could limit the inferences we can draw from data on projects that are funded. This could be especially problematic if TC requests are correlated with some of the determinants of TC allocation. I discuss these potential limitations in the Summary and Implications section, and highlight which findings in my analysis may be affected by this selection problem.

What Explains the Allocation of IAEA TC Assistance?

Existing studies offer several explanations for how IOs allocate resources to member states. One view suggests that recipients' needs, and their capacity to utilize assistance shape aid allocation. An alternative explanation maintains that donors' interests, and in particular the interests of the US, dominate recipients'

equipment and materials. The model text is available in IAEA (N.d.).

needs. Another approach argues that countries that occupy positions in key IO bodies receive more assistance than countries that do not serve in central positions. Finally, some scholars argue that assistance is given in exchange for policy concessions that recipients provide to donors or to IOs. In the rest of this section, I examine these explanations, and formulate hypotheses about the determinants of aid allocation.

Recipients' needs and their ability to put TC resources to good use

According to this view, aid allocation is need-driven, and aid is given to recipients who can use it effectively to address policy problems that led them to ask for assistance in the first place. According to this view, IO bureaucrats apply policy-oriented judgement to evaluate recipients' need and ability to use aid, and this judgements guides aid allocation.

In the spirit of this approach, some scholars suggest that IMF bureaucrats design loans based on macroeconomic factors, borrowers' needs, and the long-term debt sustainability (Bird and Rowlands, 2001). Similarly, Willett (2002) maintains that the IMF staff is motivated by genuine policy goals, such as improving the economic situation of the borrowing countries. The evidence in favor of the bureaucratic explanation is limited. In the context of the IMF lending policies, Copelovitch (2010) finds that bureaucrats influence only in cases that are less important to the interests of the major stakeholders of the Fund. He also finds mixed evidence with respect to the effect of the recipients' economic conditions on loans: GDP and per capita GDP are not associated with the likelihood of receiving a loan, whereas GDP has a positive and per capita GDP has a negative association with the amount of loan.

The declared purpose of the IAEA TC fits well with the need-driven explanation. The Agency's guidelines state that the "IAEA TC projects are designed to fill a well-identified national gap in expertise, capabilities or infrastructure, to address national development issues and to contribute to the achievement of socioeconomic goals. IAEA TC assistance is needs-driven and is provided on the principle that the recipient Member State requires expertise (scientific, legal or managerial) or complementary physical facilities that necessitate the assistance of the IAEA to ensure the optimal utilization of nuclear techniques" (IAEA, 2011, 2). Moreover, professionalism is one of the declared values of the IAEA, and the Agency urges its staff members to resist political pressures, and to be motivated by professional objectives, rather than personal concerns.[11] Historically, the IAEA leadership has also emphasized the professional, rather than political nature of the Agency (Scheinman, 1987, 209-225).

I test the need-based approach in several ways. First, if TC allocation is need-driven, then less developed

[11]The values of the IAEA are listed here: https://www.iaea.org/about/employment/values.

countries should be more likely to benefit from assistance, and should receive larger amounts of TC. However, since TC assistance is not intended to establish nuclear infrastructure from scratch, but instead to "fill a well-identified national gap in expertise, capabilities, or infrastructure" (IAEA, 2011, 2), we should not expect it to be provided to the least developed recipients, but to recipients with medium level of resources.

Hypothesis 1a *Countries with moderate level of national resources are more likely to receive TC assistance, and conditional on assistance, receive larger amounts, than the least developed and the most developed countries.*

With respect to areas of assistance, this logic implies that countries with moderate levels of resources are more likely to receive nuclear fuel-cycle assistance. The IAEA is less likely to provide such assistance to the least developed countries, since they have other, more urgent needs, and they might not possess the infrastructure to sustain fuel-cycle activities. Such assistance is also less likely to benefit highly developed countries since they have domestic capabilities to address their needs in these areas without the IAEA assistance. Thus, countries that are moderately developed are more likely to benefit from fuel-cycle-related TC assistance. Conversely, assistance with the application of nuclear technologies in agriculture and health is more likely to be channeled to less developed countries since it addresses more basic needs that these countries are more likely to have.

Hypothesis 1b *Countries with moderate level of resources are more likely to benefit from nuclear fuel-cycle assistance than the least-developed and the most-developed countries. The least-developed countries are more likely to receive assistance in health and agriculture.*

Another way to test the argument that TC allocation is need-driven is by looking at whether domestic turmoil affect the likelihood and the amounts of TC. There is anecdotal evidence that intrastate conflict may adversely affect the level of TC aid, as it happened in the case of Egypt, where TC fell after the uprising. If this logic is correct, then

Hypothesis 2a *Countries that experience intrastate conflict are less likely to receive TC , and conditional on TC, receive lower amounts than similar countries that do not experience conflict.*

Moreover, conflict should affect assistance in the most sensitive areas, and may not affect aid in agriculture and health, and might even make it more likely:

Hypothesis 2b *Intrastate conflict is associated with lower likelihood of TC in the most sensitive areas (nuclear fuel-cycle), but is not linked to the provision of TC in agriculture and health.*

Relationship with the US

An alternative view suggests that geopolitical factors, rather than policy-related considerations, affect allocation of assistance. This argument is consistent with the findings in Fuhrmann (2009*b*); Kroenig (2009*a*) that alliance and hostility among countries affect bilateral nuclear cooperation. In the IO context, several studies show how powerful actors use IOs to reward themselves or their friends. Benvenisti and Downs (2005) demonstrate how the most powerful players in WTO use coercion and brinkmanship to redistribute upwards the benefits of pharmaceutical drug regime. Other studies report that countries that vote together with the US in the UN General Assembly, and countries that receive economic and military aid from the US, enjoy better lending conditions in the IMF (Stone, 2008; Vreeland, 2005). Additional studies find a connection between the amount of debt a country has to private creditors in the US, and the size of IMF loan, suggesting that the US interests play an important role in determining the allocation of IMF lending (Broz and Hawes, 2004). Thus, alignment with the US might be correlated with a more favorable treatment by the organization.

This explanation has not been examined in the IAEA context, but it seems particularly relevant here. The US attaches high importance to nuclear issues, and in light of its prominence in IAEA as the single largest donor to the TC program, the US should be able to exert influence over who gets assistance in acquiring nuclear-related knowledge and capabilities. Anecdotal evidence does not fully support this theory: GAO (2009, 11-12) report suggests that countries that cannot receive US bilateral aid in the nuclear area due to their links with terrorism or because they are not NPT members often enjoy TC assistance from the US. Nonetheless, the geopolitical logic implies that

Hypothesis 3 *Countries that are aligned with the US are more likely to receive TC assistance. Conditional on receiving TC, they receive larger amounts of assistance than countries that are not aligned with the US.*

It is less clear how the relationship with the US should affect the areas of assistance. We might expect countries that share more preferences with the US to have a better chance to receive more sensitive aid (nuclear fuel cycle-related) than countries with opposing preferences. However, this depends on whether these countries are interested to receive such aid. For instance, some of US close friends are already very developed in the nuclear area, and thus may have no interest in the IAEA assistance. Additionally, the US allies may benefit from bilateral assistance in sensitive areas, whereas countries that cannot receive such assistance directly from the US or other nuclear states may be more interested in receiving the IAEA help.

Membership in IO's decision-making body

Another explanation suggests that states in a position to affect IO's decision-making receive material benefits in exchange for their support for policies that are allied with the US agenda. For example, Bueno de Mesquita and Smith (2010) find that non-permanent members of the UNSC receive more foreign aid from the US during their tenure in the Council, and that the aid drops to pre-Council levels once these states end their term. Similarly, Dreher, Sturm and Vreeland (2006) show that UNSC non-permanent members are more likely to receive IMF loans with fewer conditions attached to them.

These findings imply that aid serves as a foreign policy tool, rather than an instrument to address recipients' needs. Aid is not necessarily given to those who need it and to those who can put it to good use, but primarily to politically-important countries. The same logic can also be extended to the IAEA TC, where Board members can affect the Agency's decision-making. As a result, key players such as the US have an incentive to offer material benefits (for example, TC assistance) to BOG members. An additional reason why Board members may benefit more than others from TC assistance is because assistance is ultimately approved by the BOG.

Hypothesis 4 *BOG members are more likely to receive TC assistance. Conditional on receiving TC, they receive larger amounts of assistance than non-BOG members.*

However, since some of the Board members are very advanced nuclear countries, they may not seek the IAEA aid in the first place, thus offsetting the positive effect that BOG membership has on receiving TC.

This explanation can also be combined with geopolitical reasoning. While overall the US may prefer to allocate TC resources to friendly countries, it may also want to use TC assistance to appease less friendly IAEA members, especially when they serve on the Board and can affect the Agency's work. Thus, the expectation is that

Hypothesis 5 *Countries that do not share preferences with the US become more likely to receive aid, and receive more aid when they serve on the Board. Board membership should not affect allocation of TC to countries that are friendly to the US.*

As before, it is not clear how BOG membership affects the areas of the IAEA TC. On the one hand, BOG members may be in a better position to receive sensitive (fuel cycle-related) aid because they approve these requests. On the other hand, at least some of the Board members are the most advanced nuclear countries, and thus they may not seek such aid in the first place. With respect to heath and agriculture-related aid, it is not clear why BOG members should be more likely to receive it.

Concessions-for-aid

This explanation suggests that states may trade material benefits for policy concessions (Bueno de Mesquita and Smith, 2007, 2010; Urpelainen, 2012). Most evidence in favor of this argument comes from studies of bilateral foreign aid. In that context, aid is given to extract policy concessions that recipients are less willing to provide otherwise. This view implies that, countries are more likely to get aid, and receive larger amounts of aid when they are less likely to adopt certain policies on their own, and when more aid is required to convince them to adopt such policies. In the nuclear context, this is related to the argument that incentives can lead players to make nonproliferation concession. For example, Bernauer and Ruloff (1999) explore how positive incentives can change countries' behavior on nonproliferation. cost of compliance argument. Similarly, Levite (2003) also demonstrates that the promise of bilateral nuclear civilian cooperation has played an important role in dissuading some countries from acquiring nuclear weapons. Verdier (2008) makes the argument about the differential costs of compliance, whereby countries with low cost of compliance with NPT (those that are not interested in acquiring nuclear weapons regardless of the treaty) enjoy only the benefits of the multilateral arrangement, whereas those with higher costs receive also bilateral incentives to encourage them to comply.

In the IAEA TC context, this logic suggests that countries that adopt policies viewed as desirable by the IAEA or by key players within the Agency, such as the US, are rewarded with TC assistance, and that TC assistance is more likely to benefit those recipients whose interests lie farther away from the US interests. One such policy is the AP that the US, the IAEA, and many other influential countries see as a necessary tool to strengthen the Agency's nonproliferation safeguards.

Hypothesis 6 *Countries that share fewer preferences with the US are more likely to receive TC funds, and are more likely to receive larger amounts of TC funds when they join the AP.*

Data

To test these hypotheses, I compile a dataset of all countries that are IAEA members between 2004 and 2012. There are 157 countries in the dataset, 137 of them appear every year, and the remaining 20 join the Agency during this period, and appear only during the years in which they are members. The unit of analysis is country-year (N=1,313).

Dependent variables: participation in IAEA TC

The first dependent variable is $TC\ RECIPIENT_{i,t}$, coded one if country i requests and receives TC in year t, and zero if it does not receive TC (either because it does not request, or because it requests and is being denied). I use the annual IAEA TC Reports to extract data on recipients (IAEA, 2004-2012).

The second dependent variable is $TC\ AMOUNT_{i,t}$, and it measures the logged amount disbursed to country i in year t from TCF.[12] This variable is measured only for those states that receive TC in a given year ($TC\ RECIPIENT$ =1).

Finally, to analyze what affects the substantive area of assistance, I use the list of projects supported by the Agency in every recipient country.[13] This list provides the title and the field of activity of every project, but not the amounts disbursed or the mode of assistance. Still, it allows to learn about the substantive area in which countries receive assistance from the Agency in a given year. Based on this list, I code two dichotomous variables. $FUEL\ CYCLE_{i,t}$ is coded one if country i receives fuel-cycle-related TC assistance in year t, and is coded zero if it does not receive such assistance, conditional on receiving TC. A project is considered to be fuel-cycle-related if it falls within field of activity coded as 3 in the IAEA Table (Fuel Cycle and Waste Management, not including waste management projects), or 4 (Nuclear Engineering and Technology). This is also the set of projects considered in Brown and Kaplow (2014). Additionally, for each recipient i in year t, I code whether they receive assistance in agriculture or health. The variable $HUMANITARIAN_{i,t}$ is equal to one if such assistance was provided, and is equal to zero if not. Agriculture-related projects are those for which the field of activity is coded 5, and health-related projects are those that belong to the field of activity coded 6.

Independent variables

To test the need-based explanation, I approximate country's resources using $GDP_{i,t-1}$ that is the logarithm of one-year lagged GDP, controlling for population size, $POPULATION_{i,t-1}$.[14] I also include the quadratic term of $GDP_{i,t-1}$ to account for a possible nonlinear relationship between economic development and TC assistance. If countries with moderate level of resources benefit more than the least developed or the most

[12] I exclude disbursements from extra-budgetary sources or from donations since their allocation can follow a different logic from the one that guides TCF allocation. Table 1 shows that extra-budgetary sources and donations account for a small share of TC. I also do not include amounts that countries receive through regional projects.

[13] http://www-tc.iaea.org/tcweb/tcprogramme/selectdatagroup/default.asp

[14] Following the method in Bueno de Mesquita and Smith (2007, 272), I use Penn World Tables 7.1 (Heston, Summers and Aten, 2012). The variable $GDP_{i,t-1}$ is calculated using the following formula: $ln(POPULATION_{i,t-1} \times RGDPCH_{i,t-1} \times KG_{i,t-1})$, where $POPULATION$ is population size, $RGDPCH$ is the real per capita GDP in constant 2005 $US, and KG is the government share of real GDP in country i in year $t-1$.

developed, then the coefficient of the quadratic term should be negative.

To estimate the relationship between intrastate conflict and TC, I use $CONFLICTS_{i,t-1}$ that measures the number of active violent intrastate conflicts in country i in year $t-1$. I obtain the data on conflicts from country-year version of the UCDP/PRIO Armed Conflict Dataset v.4-2012 (Gleditsch et al., 2002; Themnèr and Wallensteen, 2014). A country is considered as having a conflict if it experiences 25 or more casualties due to an intrastate armed confrontation in a given year.[15]

To assess the association between TC allocation and geopolitical variables, I use the measure of distance between the ideal policy points of the US and each of IAEA members, called $US\ DISTANCE_{i,t-1}$. Ideal point data are obtained from Bailey, Strezhnev and Voeten (Forthcoming), and they are measured using similarity of voting in the UN General Assembly.[16] If countries aligned with US benefit more from TC aid, then the coefficient of $US\ DISTANCE_{i,t-1}$ should be negative.

Data on BOG membership are available on the IAEA website. For each country-year, I code $BOG_{i,t-1}$ one if country i serves on the Board in year $t-1$, and zero otherwise. In some specifications, I also distinguish between elected and designated Board members: $ELECTED_{i,t-1}$ and $DESIGNATED_{i,t-1}$ are coded one if country i is elected or designated, respectively, in year $t-1$ to serve on the Board. I expect the coefficients of these variables to be positive if serving on the Board increases BOG member's likelihood of enjoying TC assistance. To test Hypothesis 5, I interact between $BOG_{i,t-1}$ and $US\ DISTANCE_{i,t-1}$, and between different types of BOG members and distance to US.

Membership in AP measures concessions that countries make. $AP_{i,t-1}$ is equal to one if country i's AP is in force in year $t-1$, and is equal to zero if country i does not have the AP in force in year $t-1$. Data on AP membership is available on the IAEA website.[17] To test Hypothesis 6, I include an interaction term between $AP_{i,t-1}$ and $US\ DISTANCE_{i,t-1}$.

Control variables

Other factors can also affect the allocation of TC assistance. I control for population size, since more populous countries may receive larger amounts of aid. $POPULATION_{i,t-1}$ measures the logged number of residents in country i in year $t-1$.

[15] An alternative measure of conflict could be terrorist attacks within a country. However, using low-intensity intrastate conflict is a better measure because terrorist attacks do not necessarily undermine the government's ability to control its territory, control nuclear materials, or pursue developmental goals beyond pure survival.

[16] Specifically, for each country i I calculate the absolute value of the difference between that country's ideal point and the ideal point of the US in year $t-1$, and rescale this variable to be between zero and one, such that zero indicates full alignment with the US, and one indicates the farthest ideal point from the US ideal point.

[17] See http://www.iaea.org/safeguards/documents/AP_status_list.pdf.

I also control for whether a country is new to the IAEA, since new members may be less familiar with the Agency, and less likely to apply for TC. $NEW\ MEMBER_{i,t-1}$ is equal to one if country i is an IAEA member for less than five years in year $t-1$, and is equal to zero otherwise.

Brown and Kaplow (2014) show that countries with nuclear weapons programs are more active consumers of TC resources. I, therefore, control for the presence of a nuclear weapons program in a country by including the $NWPROGRAM_{i,t-1}$ indicator. Since this paper covers a relatively recent period, I use the online reports of the Institute for Science and International Society (ISIS).[18] During the period covered here, the US, UK, France, Russia, China, Israel, India, and Pakistan are coded as having an on-going nuclear weapons program. North Korea is not included in my analysis because it is not an IAEA member. I also code Iran as having a nuclear weapons program during the entire period, and Syria starting in 2007 because ISIS codes them as suspicious cases.

I use membership in the Nuclear Suppliers Group (NSG) in year $t-1$ ($NSG_{i,t}$) to account for the possible effect of nuclear capabilities on TC participation and amounts of aid. NSG is a voluntary group of countries that export items that could be used in the development of nuclear weapons. Participation in this group can potentially increase the likelihood of receiving TC assistance, or the likelihood of receiving larger amounts of assistance because it enhances confidence that this assistance will not be misused or transferred to countries that should not receive it. Data on NSG participation is available from the annual public statements on the group's website.[19]

I also control for political regime type by including a variable $DEMOCRACY_{i,t-1}$ that ranges from zero to one, with higher values representing more democratic regimes.[20] I control for regime because previous studies find a connection between recipient's regime, bilateral foreign aid (Bueno de Mesquita and Smith, 2007), and nuclear cooperation (Fuhrmann, 2009*b*).

I also control for whether a country signed an RSA with the Agency, and whether it is in good standing in terms of its financial obligations to the TCF because this variable can affect the amount of TC (Aning, 2014). I include a binary indicator $RSA_{i,t-1}$ that is equal to one if a country signed an agreement on provision of aid, and equal to zero otherwise.[21] Also, I include $RATE\ OF\ ATTAINMENT_{i,t-1}$ that measures the share

[18] These data are available here: http://isis-online.org/nuclear-weapons-programs. Previous quantitative studies of nuclear proliferation coded the presence of a nuclear program at most until 2002 (Fuhrmann, 2009*b*; Jo and Gartzke, 2007; Kroenig, 2009*b*). Since the IAEA data are available from 2004 and onwards, I use ISIS data to code the presence of a nuclear weapons program for these years.

[19] http://www.nuclearsuppliersgroup.org/en/nsg-documents.

[20] To create this variable I use the following formula: $DEMOCRACY_{i,t-1} = \frac{Democracy\ Score_{i,t-1}\ -\ Autocracy\ Score_{i,t-1}\ +10}{20}$ (Marshall, Jaggers and Gurr, 2013).

[21] The list of countries with RSA was obtained here: http://www.iaea.org/Publications/Documents/Conventions/rsa_status.pdf.

Table 2: Summary statistics

Variable	Obs	Mean	Standard deviation	Min.	Max
TC RECIPIENT	1313	0.78	0.42	0	1
TC AMOUNT (log)	1313	9.73	5.31	0	14.46
FUEL CYCLE	1313	0.13	0.34	0	1
HUMANITARIAN	1313	0.28	0.45	0	1
GDP (log)	1126	27.16	1.74	22.16	32.66
POPULATION (log)	1126	16.25	1.64	9.93	21.00
DEMOCRACY	1243	0.71	0.31	0	1
CONFLICTS	1103	0.22	0.64	0	6
US DISTANCE	1310	0.62	0.20	0	1
BOG	1313	0.24	0.43	0	1
ELECTED	1313	0.22	0.42	0	1
DESIGNATED	1313	0.09	0.29	0	1
AP MEMBER	1313	0.50	0.50	0	1
NEW MEMBER	1313	0.07	0.26	0	1
POWER REACTOR	1313	0.20	0.40	0	1
NSG	1313	0.30	0.46	0	1
NCA	1313	0.11	0.31	0	1
NWPROGRAM	1313	0.07	0.25	0	1
RSA COUNTRY	1313	0.75	0.44	0	1
RATE OF ATTAINMENT	1124	0.63	0.50	0	5.88

that country i paid to the IAEA TC out of the total amount it is expected to pay.

Table 2 reports summary statistics of all the variables.

Findings

The Likelihood of Receiving TC

I use a logit model, adjust for duration dependence by controlling for the number of years since the previous TC and including cubic splines (Beck, Katz and Tucker, 1998), and employ robust standard errors clustered by country to correct for spatial dependence.

Table 3 reports the results of four logit models. I start with a simple model without controls, then add controls, and afterwards add interactions between *BOG* and *US DISTANCE*, and between *AP* and *US DISTANCE*. $GDP_{i,t-1}$ has a negative and statistically not significant association with TC participation in models without the quadratic term. Once the quadratic term $GDP^2_{i,t-1}$ is added, the coefficient of $GDP_{i,t-1}$ becomes positive and significant. The coefficient of the quadratic term is negative and also significant. This result implies that likelihood of receiving assistance is highest for intermediate values of GDP, but the probability of participating in TC is lower at both ends of the GDP range. This finding supports *Hypothesis*

Table 3: Participation in TC

	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.
GDP (log)	-0.11	11.29***	13.11***	11.66***
	(0.16)	(3.66)	(4.21)	(3.90)
GDP (log) square		-0.22***	-0.26***	-0.23***
		(0.07)	(0.08)	(0.08)
Conflicts	-0.32	-0.76**	-1.03**	-0.68*
	(0.33)	(0.36)	(0.42)	(0.40)
US Distance	5.77***	3.82*	-3.12	2.29
	(1.25)	(2.19)	(4.72)	(2.30)
BOG member	-0.63**	-0.22	-6.58**	-0.29
	(0.25)	(0.53)	(3.31)	(0.54)
BOG member × US Distance			14.55*	
			(8.28)	
AP member	-0.76**	0.18	0.10	-3.06**
	(0.33)	(0.37)	(0.37)	(1.44)
AP member × US Distance				6.15**
				(2.87)
Population (log)		0.62	0.55	0.54
		(0.38)	(0.37)	(0.40)
Democracy		-1.13	-1.79	-1.26
		(1.06)	(1.15)	(1.12)
New member		-2.80***	-2.58***	-2.69***
		(0.94)	(0.95)	(1.01)
NSG member		-1.42*	-2.99*	-1.33
		(0.86)	(1.81)	(0.92)
NW Program		3.58***	3.48***	3.34***
		(1.18)	(1.15)	(1.27)
RSA agreement in force		3.31***	3.34***	3.41***
		(0.59)	(0.65)	(0.64)
Constant	1.86	-152.55***	-170.40***	-156.12***
	(4.60)	(50.19)	(56.06)	(53.30)
Adjustment for duration dependence	No	Yes	Yes	Yes
Pseudo R^2	0.25	0.79	0.80	0.79
No. of obs	1088	1066	1066	1066

Note: Logit coefficients and robust standard errors clustered by country in parentheses. The dependent variable is $TC\ RECIPIENT_{i,t}$, equal one if country i received TC in year t, and equal zero otherwise. The first column presents results without controls, and without adjustment for time dependence. The second column adds controls and adjustment for duration dependence. The third column adds the interaction between $BOG_{i,t}$ and $US\ DISTANCE_{i,t}$. The fourth column presents the interaction between $AP_{i,t}$ and $US\ DISTANCE_{i,t}$

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

1a, according to which countries with moderate levels of resources are more likely to receive TC assistance.[22]

Intrastate conflict has a negative relationship with TC participation, but it becomes statistically significant only once control variables are added. This finding is consistent with the idea that TC funds are given to recipients that can demonstrate that they can put them to good use (*Hypothesis 2a*).

With respect to shared interests with the US, the coefficient of $US\ DISTANCE_{i,t-1}$ is positive and significant in models without interactions. However, it loses significance and in one case changes its sign when interactions and control variables are added. This suggests that alignment of policy preferences with the US does not have a direct impact on the likelihood of receiving TC, contrary to the geopolitical logic (*Hypothesis 3*). It is important to note that this result may also be affected by the tendency of some close US allies not to apply for TC due to their advanced economic and nuclear status. Had those countries applied for TC, perhaps the effect of $US\ DISTANCE_{i,t-1}$ would have been different. However, some US allies are among TC recipients, and these results suggest that their proximity to the US does not increase their likelihood of receiving assistance compared to other similar IAEA members whose ideal point lies farther away from the US.

Membership in the BOG has the opposite relationship from what is expected in *Hypothesis 4*: BOG members are less likely to request and receive TC assistance since the coefficient of this variable is negative in all specifications, and statistically significant in model without controls, and in model with controls and interaction between *BOG* and *US DISTANCE*. The negative relationship between BOG membership and the likelihood of receiving TC could be due to the fact that countries that are very advanced in the nuclear area tend to serve on the Board, and are also less likely to request assistance from the Agency. Thus, to see if BOG membership affects the likelihood of TC through another variable, I examine the interaction between $BOG_{i,t-1}$ and $US\ DISTANCE_{i,t-1}$.

The interaction results in three findings: 1) the coefficient of *BOG* is still negative and statistically significant. This is because the US and countries perfectly aligned with it are less likely to receive TC; 2) the coefficient of $US\ DISTANCE_{i,t-1}$ is no longer statistically significant, suggesting that US friends are not worse off than countries with opposing interests in terms of their likelihood to receive TC assistance; and 3) the interaction term is positive and significant. This implies that among BOG members with preferences more distant from the US are more likely to receive TC assistance.

Figure 3 presents the average marginal effect of being a BOG member on the probability of receiving TC

[22]Examining the predicted probabilities of TC for various levels of GDP suggests that there is no statistically-significant difference between the very poor and the middle-range countries, although the point estimates for the latter are higher than the point estimates for the former.

conditional on distance from the US ideal point. For countries that are aligned with the US (lower values on the x-axis), the Figure shows that they are less likely to receive TC when they are members of the Board. The Figure shows the opposite for countries whose preferences are far away from the US ideal point (higher values on the x-axis): they are more likely to receive TC when they serve on the Board than when they do not serve on the Board. In terms of the substantive effects, the Figure shows that for countries that are very far from the US ideal point (0.75 or greater), serving on the Board increases their likelihood of TC by about 10 percentage points. Conversely, being a BOG member results in a decrease of about 70 percentage points in the likelihood of TC for countries that share many preferences with the US (0.05-0.1). This finding strongly supports *Hypothesis 5*. To illustrate this finding, consider the case of Syria – a country that shares very little interests with the US (distance of 0.95 on a scale between zero and one, where zero means perfect alignment with the US preferences). Syria served on the BOG in 2005-2006. Prior and during its tenure, the TC amounts Syria received ranged between $486,000 and $526,000 per year. Following its tenure, Syria received $1,296,000 and $838,000 approved during its time on the Board.

Interestingly, the marginal effect of BOG membership on the likelihood of TC appears to be stronger for countries that are close to the US ideal points (see the left hand side of Figure 3 compared to the right hand side). One explanation could be that some US friends are less likely to apply for TC because they are high-income countries that are also advanced in the nuclear area. As such, they are more likely to serve on the Board (since Board membership is correlated to some extent with nuclear development). Thus, the left hand side of Figure 3 may be affected by this selection effect whereby some countries that are very friendly to the US, are more likely to be on the Board, and are also less likely to request TC. Indeed, non-recipients of TC are closer to the US ideal point than recipients.[23] The right hand side of Figure 3 is not driven by this selection since it reflects a comparison between BOG and non-BOG members with preferences that lie far from the US ideal point. Because selection effects (in this case, lack of interest in TC) are more likely to apply to US friends[24], the finding with respect to non-friends is not likely to be driven by these effects.

Moving on to examining the relationship between the likelihood of TC, distance to the US, and membership in AP, I interact $AP_{i,t-1}$ with $US\ DISTANCE_{i,t-1}$. Figure 4 shows the marginal effect of joining the AP. Similarly to Figure 3, it appears that AP members that are far from the US ideal point are more likely to receive TC compared to similar non-AP countries. The opposite is true with respect to countries that share US policy preferences: they appear to be less likely to receive TC when they are AP member compared to similar non-members. Furthermore, the effect of AP membership appears to be stronger for

[23] The mean distance is 0.44 and 0.67 for non-recipients and recipients, respectively.
[24] See Table A1 in supporting material

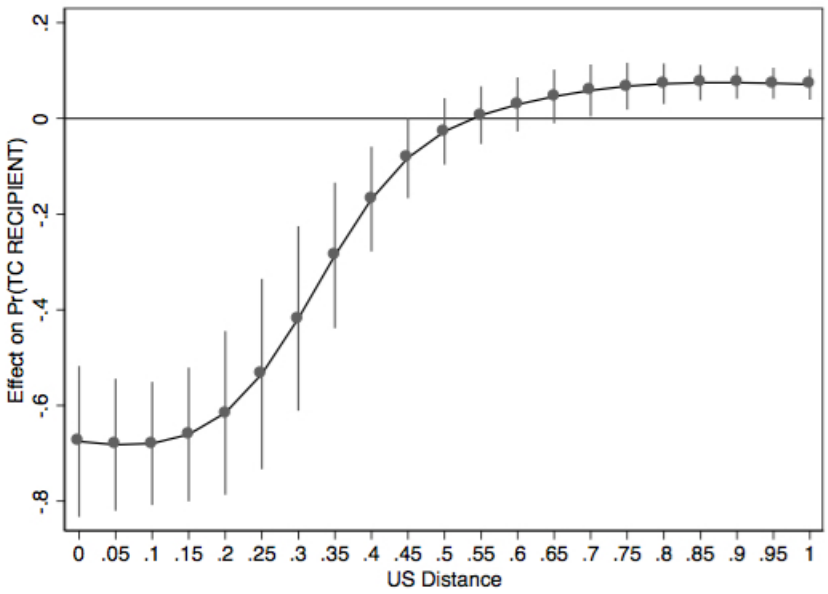

Figure 3: Average marginal effect of being in BOG on the likelihood of receiving TC with 95% confidence interval

countries that are close to the US ideal point (the drop on the left hand side is greater than the increase on the right hand side). For example, AP members that are 0.05 points away from the US are associated with a decrease of about 60 percentage points in their likelihood of receiving TC compared to non-AP members with the same policy preferences. The likelihood of TC for AP members that are about 0.95 points away from the US increases by about 10 percentage points when they compared to similar non-AP countries. The United Arab Emirates (UAE) is a case in point. It signed the AP in 2009, and its membership came into force in 2010). The UAE's ideal point is far from the US preferences (about 0.85 on a scale between zero and one). Prior to 2009, the UAE received on average less than $100,000 per year in TC assistance. In 2009 (the year it signed the AP), the TC increased to $455,700. In subsequent years, the UAE's annual TC has ranged between $397,137 - $706,727. Unlike the UAE, Qatar has not joined the AP. Although Qatar has received considerable TC assistance (average of about $160,000 per year), it has not spiked as much as UAE's TC during these years.

Similarly to the finding on BOG membership, one explanation for this result may be that many of US friends that are also AP members do not request TC (and thus do not receive assistance) since they are advanced enough in the nuclear area. As before, this possible selection effect could shape the left hand side of the Figure, but not the right hand side – the finding with respect to countries that do not share

the US preferences. The results with respect to them are based on comparison between AP members and non-members with policy preferences that lie far from the US ideal point. In robustness tests, I show that the results with respect to these countries are not affected by data availability with respect to US friends.

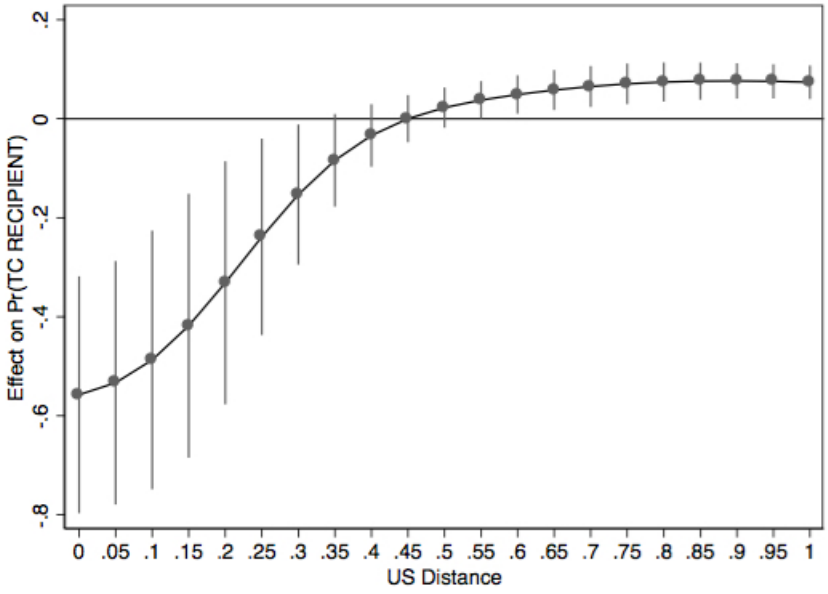

Figure 4: Average marginal effect of joining the Additional Protocol on the likelihood of receiving TC with 95% confidence interval

Among the control variables, $POPULATION_{i,t-1}$ does not seem to be related to likelihood of TC. The coefficient of $DEMOCRACY_{i,t-1}$ is negative, but statistically not significant. Being a new member of the IAEA is negatively associated with TC participation. Being NSG member (nuclear supplier) is negatively related to TC assistance, though this relationship is not very robust. Having an active nuclear weapons program has a positive relationship with TC. Finally, having a TC provision agreement with the Agency (RSA) has a positive association with the likelihood of TC.

Amount of TC assistance

Table 4 focuses on country-years that receive TC, and examines the factors that are related to larger amounts of TC. The number of observations is smaller than in Table 3 because country-years that do not participate in TC are dropped. The dependent variable, $TC\ AMOUNT_{i,t}$ is continuous, and therefore I use a linear regression, and control for the lagged dependent variable (LDV, or TC amounts in the previous year) to account for path-dependence (Angrist and Pischke, 2008).

Table 4: Amounts of TC

	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.
GDP (log)	0.01	-0.68	-0.14***	-0.14***	-0.15***
	(0.04)	(0.54)	(0.05)	(0.05)	(0.05)
GDP (log)		0.01			
square		(0.01)			
Conflicts	0.16**	-0.04	-0.06	-0.05	-0.03
	(0.07)	(0.06)	(0.06)	(0.06)	(0.06)
US Distance	0.89***	0.09	0.07	-0.26	-0.01
	(0.27)	(0.30)	(0.29)	(0.28)	(0.29)
BOG member	0.17**	0.11	-0.20	0.09	
	(0.07)	(0.08)	(0.34)	(0.08)	
BOG member			0.46		
×US Distance			(0.45)		
AP member	-0.07	-0.07	-0.07	-0.91***	-0.08
	(0.07)	(0.07)	(0.07)	(0.33)	(0.07)
AP member				1.28***	
×US Distance				(0.46)	
Population (log)		0.26***	0.27***	0.26***	0.26***
		(0.05)	(0.05)	(0.05)	(0.05)
Democracy		-0.02	-0.02	-0.04	-0.01
		(0.13)	(0.13)	(0.13)	(0.13)
New member		0.11	0.11	0.11	0.11
		(0.27)	(0.27)	(0.27)	(0.27)
NSG member		-0.25	-0.22	-0.14	-0.23
		(0.18)	(0.17)	(0.17)	(0.19)
NW Program		0.06	0.14	0.10	0.12
		(0.20)	(0.18)	(0.19)	(0.14)
Rate of attainment		0.16**	0.15**	0.14**	0.15**
		(0.06)	(0.06)	(0.06)	(0.06)
Elected BOG					-0.08
					(0.32)
Elected BOG					0.39
× US Distance					(0.45)
Designated BOG					-3.60**
					(1.58)
Designated BOG					5.56**
×US Distance					(2.17)
LDV	0.31***	0.29***	0.29***	0.29***	0.29***
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Constant	7.97***	15.72**	8.37***	8.66***	8.94***
	(0.97)	(7.47)	(0.94)	(0.90)	(0.93)
R^2	0.405	0.445	0.446	0.455	0.451
No. of obs	772	758	758	758	758

Note: OLS coefficients and robust standard errors clustered by country in parentheses. The dependent variable is $TC\ AMOUNT_{i,t}$ measured only for countries that receive TC. The first column presents results without controls, and without adjustment for time dependence. The second column adds controls and adjustment for duration dependence. The third column adds the interaction between $BOG_{i,t}$ and $US\ DISTANCE_{i,t}$. The fourth column presents the interaction between $AP_{i,t}$ and $US\ DISTANCE_{i,t}$
* p < 0.10, ** p < 0.05, *** p < 0.01

The results in Table **??** suggest that economic development is negatively related to the amount of TC resources a country receives, though unlike the probability of TC, here there is no non-linear relationship between GDP and the amount of assistance. The inclusion of the quadratic term renders both coefficients statistically not significant, and I therefore drop the quadratic term from the remaining models. Based on these results, I conclude that recipients with fewer resources receive more aid, and the amount of TC assistance is decreasing in the recipient's resources. This result is only partially supportive of *Hypothesis 1a*: countries in the middle do not receive more TC aid.

Intrastate conflict is not consistently related to the amounts of aid countries receive from the IAEA. The coefficient of $CONFLICTS_{i,t}$ is positive and statistically significant in the model without controls. However, it becomes negative and statistically not significant in other models. This result does not support the argument that more resources are given to countries that can put them to good use: having more violent domestic conflicts does not seem to lead to a decrease in the amounts of TC, conditional on receiving aid.

Proximity to the US is also not a good predictor of the amount of TC assistance. The coefficient of *US* $DISTANCE_{i,t}$ is positive in some models, suggesting the opposite from *Hypothesis 3*. It is significant only in the model without control variables. Overall, this implies that among countries that receive TC, those that share interests with the US are not more likely to receive larger amounts of TC assistance.[25]

Hypothesis 4, according to which members of the Board receive larger amounts of TC assistance, is also only partially supported by these tests. The coefficient of $BOG_{i,t}$ is positive and significant in the model without controls, but loses its significance and even changes sign when control variables and interaction terms are included. The interaction term is also statistically not significant. A potential reason for these results could be that Board members differ in terms of their ability to extract more resources for their TC projects. Some BOG members serve on the Board only occasionally, whereas others are quasi-permanent and have a lot of experience in the Agency. To examine this possibility, I distinguish between elected and designated Board members.

A closer examination of Board members in the last column of Table **??** suggests that only the designated BOG members differ in terms of the amount of aid that they receive: $DESIGNATED_{i,t}$ is negative and statistically significant, suggesting that designated BOG members with preferences identical to the US receive lower amounts of aid when on the Board. The interaction term is positive and statistically significant, suggesting that designated Board members receive more when their preferences lie far from those of the

[25] In this context, it is important to recall that some US allies – the high income countries – tend not to apply for TC, and this result is based on those IAEA members that apply and receive assistance.

US.[26] This result partially supports the predictions of *Hypothesis 5* that service on the Board benefits countries that are not aligned with the US more than countries that share US interests.

In terms of the substantive effect, these results suggest that a country like South Africa that is relatively distant from the US ideal point (about 0.75 on 0-1 scale) receives 77% more aid than a similar country that is not a designated BOG member (95% confidence interval is 21%-159% increase in the amount of aid).[27] TC to Argentina – a country slightly more friendly to the US (distance of about 0.6), is not significantly affected by Argentina's service on the Board. The results suggest that when a country like Argentina is designated to the Board, it receives about 23% less aid than a similar country not on the Board, but this result is not statistically-significant (the 95% confidence interval is -60%-46%).

The results further suggest that while being AP member does not affect the amounts of resources that countries receive, AP members whose preferences lie farther away from the US receive larger disbursements than AP members that share more interests with the US. This result supports *Hypothesis 6*. The substantive effect also appears to be very significant. A case in point is Cuba that became AP member in 2004. Cuba's preferences are very far from the US ideal point (about 0.9 on 0-1 scale). Cuba also serves very often on the Board, though as an elected and not as a designated member. When a country like Cuba becomes AP member, its TC amounts increase by 27% (95% confidence interval is 1%-60%). Greece, who is a more friendly country to the US (0.4 distance on 0-1 scale) joined the AP the same year as Cuba. A country like Greece that is AP member receives 33% smaller amounts of TC (95% confidence interval is -9%–50%) compared to a similar country that is not AP member.

Among the control variables, the coefficient of $POPULATION_{i,t-1}$ is positive and statistically significant in all models, thus highlighting that more populous countries receive larger allocations. A good financial record of supporting the TCF is also positive and significant for the amounts of aid, suggesting that the Agency reciprocates by allocating larger amounts to those countries that contribute their share. The lagged dependent variable is also positive and statistically significant, suggesting that there is continuity in the amounts that countries receive from the IAEA. Political regime, tenure in the IAEA, level of nuclear development, and the presence of an active nuclear weapons program appear to be unrelated to the amounts of aid that TC participants receive.

[26] Examples of such countries include Cuba, South Africa, Argentina, and Brazil that often serve as designated members of the Board.

[27] Using the margins command in Stata, I calculate the predicted effect of BOG membership on the amounts of TC for countries with 0.75 distance from the US ideal point. The result is 0.57 (95% CI is 0.20-0.95). Since the dependent variable is in log form, I use the following formula to calculate the percent change in aid allocation: $\%\Delta y = 100 \times (e^{\beta_1} - 1)$. In this case, β=0.57.

Areas of Assistance

Table 5 examines TC assistance in two areas – nuclear fuel-cycle and the application of nuclear technologies in agriculture and health. In particular, these tests analyze whether country's level of resources and intrastate conflict affect aid in these two areas. In these regressions, I use all IAEA members (not only TC recipients).

The results in Table 5 suggest that recipient's resources are not associated with TC assistance in fuel-cycle, contrary to Hypothesis 1b. Initially, the coefficient of $GDP_{i,t-1}$ is positive and statistically significant, but it loses its significance when control variables and the quadratic term are added.

The finding with respect to agriculture and health assistance is more supportive of *Hypothesis 1b*: the coefficient of $GDP_{i,t}$ is negative and statistically significant except when the quadratic term is introduced. This suggests that recipients with fewer resources are more likely to receive assistance in areas related to agriculture and health.

There is no indication that intrastate conflicts are related to nuclear fuel-cycle assistance, in contradiction to *Hypothesis 2b*. There is also no relationship between conflict and assistance in agriculture and health, though this finding is consistent with *Hypothesis 2b*.

Relationship with the US is not a good predictor of TC assistance in neither of these areas, and neither is membership in the Board. With respect to the AP, it is interesting to note that AP members are less likely to receive assistance related to fuel cycle, though this result is significant only in a model with no controls. Population size exhibits a positive and statistically significant relationship with assistance in both areas, though it is more statistically significant with respect to agriculture and health. The coefficient of $NSG_{i,t-1}$ is positive and statistically significant at 10% with respect to fuel-cycle assistance, and negative and not statistically significant with respect to assistance in agriculture and health. This suggests that, just like with the GDP, countries that are more developed in the nuclear area are more likely to receive fuel-cycle assistance. Having an active nuclear weapons program is not associated with assistance neither in nuclear fuel-cycle nor in health and agriculture. New members are not less likely than other to receive aid in these two areas. Finally, having a TC provision agreement (RSA) is a good predictor of assistance.

Robustness checks

Figures 3 and 4 demonstrate that BOG and AP membership have a bigger absolute effect on countries that share the US preferences than on countries that are far away from the US ideal point. This is puzzling because it implies that being a BOG member and joining the AP punishes the US friends more than it rewards its enemies. One reason for this finding could be that US friends are developed countries that do

Table 5: The likelihood of receiving nuclear fuel-cycle TC and agriculture and health TC

	Nuclear fuel-cycle			Agriculture and health		
	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.	Coef./Std. err.
GDP (log)	0.34***	0.22	3.42	-0.22***	-0.43***	0.89
	(0.10)	(0.15)	(2.25)	(0.08)	(0.11)	(2.20)
GDP (log)			-0.06			-0.02
square			(0.04)			(0.04)
Conflicts	-0.28	-0.03	-0.12	0.05	-0.00	-0.02
	(0.24)	(0.27)	(0.30)	(0.18)	(0.17)	(0.17)
US Distance	1.35	1.14	1.23	2.88***	1.65	1.71*
	(0.92)	(1.45)	(1.51)	(0.68)	(1.03)	(1.01)
BOG member	0.24	0.36	0.37	0.27	0.35	0.37
	(0.36)	(0.32)	(0.31)	(0.24)	(0.24)	(0.24)
AP member	-0.61	-0.57	-0.50	-0.17	-0.14	-0.14
	(0.38)	(0.39)	(0.38)	(0.18)	(0.17)	(0.18)
Population (log)		0.10	0.16		0.26**	0.28**
		(0.16)	(0.17)		(0.12)	(0.12)
Democracy		0.14	0.16		-0.14	-0.12
		(0.58)	(0.59)		(0.34)	(0.34)
New member		0.27	0.41		-0.08	-0.12
		(1.10)	(1.11)		(0.64)	(0.63)
NSG member		0.87*	0.93*		-0.14	-0.10
		(0.51)	(0.54)		(0.37)	(0.37)
NW Program		0.42	0.76*		0.05	0.23
		(0.46)	(0.46)		(0.67)	(0.73)
RSA agreement		2.80***	2.71***		1.55***	1.46***
in force		(0.93)	(0.91)		(0.40)	(0.40)
Constant	-14.58***	-16.00***	-60.90*	-0.69	0.27	-17.79
	(3.25)	(3.81)	(32.25)	(2.18)	(2.21)	(29.78)
R^2						
No. of obs	1088	1066	1066	1088	1066	1066

Note: OLS coefficients and robust standard errors clustered by country in parentheses. The dependent variable is $TC\ AMOUNT_{i,t}$ measured only for countries that receive TC. The first column presents results without controls, and without adjustment for time dependence. The second column adds controls and adjustment for duration dependence. The third column adds the interaction between $BOG_{i,t}$ and $US\ DISTANCE_{i,t}$. The fourth column presents the interaction between $AP_{i,t}$ and $US\ DISTANCE_{i,t}$

* p < 0.10, ** p < 0.05, *** p < 0.01

not participate in TC, and thus it appears that BOG and AP membership have a negative effect on them. To explore whether this negative effect drives the apparent positive effect of BOG membership and joining the AP on countries that do not share the US interests, in Table 6, I exclude countries that are close to the US ideal point (*US DISTANCE*<0.67, the median distance). This reduces the sample size from 1066 country-years to 530.[28] Results in Table 6 are similar to results in Table 3 . Thus, I conclude that the results in Table 3 (especially the results with respect to countries that are far from the US ideal point) are not driven by the negative association between BOG membership and joining the AP on US friends.

Summary and Implications

This paper explains what affects the allocation of the IAEA TC resources – the main vehicle through which the IAEA provides assistance to its member states in the application of nuclear technologies to peaceful uses. I focus on four theoretical explanations for TC allocation: need- and capacity-driven aid, proximity to the US interests, membership in key decision-making bodies, and concessions-for-aid. I examine how these explanations affect the likelihood of requesting and receiving TC, the amounts of TC, and the substantive field of TC. I find that countries with moderate levels of resources are more likely to receive TC assistance than very high- and very low-income countries. However, conditional on receiving TC, countries with lower GDP receive higher amounts of assistance – a finding that is consistent with the need-based allocation argument. Similarly, I find that they are also more likely to receive aid in health and agriculture areas. Together these results imply that need-based explanations matter, especially when it comes to areas closely related to development (health and agriculture).

The findings also suggest that political factors matter. Although shared policy preferences with the US, BOG membership, and concessions in most cases are not directly related to TC allocation, their effects are conditional on each other. In particular, countries that do not share many preferences with the US are more likely to receive TC when they become BOG members, or when they join the AP – a concession valued by the IAEA and the powerful players. Additionally, the amount of assistance is related to some political factors. Countries that do not share the US policy preferences receive more assistance when they join AP than similar countries that are not AP members. These findings support studies that highlight the role of foreign aid in extracting policy concessions that recipient countries would not have made otherwise (Bueno de Mesquita and Smith, 2007). Likewise, these countries receive larger amounts of TC when they serve as designated

[28] I can no longer estimate the coefficient of $NSG_{i,t-1}$ because most of the country-years left are not members in the NSG.

Table 6: Participation in TC excluding countries that are close to the US ideal point

	Coef./Std. err.	Coef./Std. err.
GDP (log)	15.26***	18.31*
	(5.80)	(9.56)
GDP (log) square	-0.27**	-0.33*
	(0.11)	(0.18)
Conflicts	-0.48	-0.37
	(0.70)	(0.96)
US Distance	-3.13	-0.42
	(6.21)	(7.45)
BOG member	-23.64***	-1.42
	(8.05)	(1.76)
BOG member × US Distance	29.58**	
	(11.99)	
AP member	2.28**	-705.34***
	(1.12)	(211.09)
AP member × US Distance		1046.75***
		(312.84)
Population (log)	-0.66	-0.60
	(0.62)	(0.63)
Democracy	0.99	1.06
	(1.20)	(1.23)
New member	-5.08***	-5.26***
	(1.44)	(1.69)
NSG member	0.00	0.00
	(.)	(.)
NW Program	1.48	1.52
	(1.61)	(1.45)
RSA agreement in force	0.51	0.29
	(1.03)	(1.18)
Constant	-195.34**	-236.56*
	(76.27)	(125.31)
R^2		
No. of obs	530	530

Note: Standard errors in parentheses. These results are comparable to Table 3, two rightmost columns. Here I exclude countries with ideal point <0.67 (the median distance from the US).
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

members of the Board than similar countries that are not on the Board.

Similarly to other studies that explore the determinants of aid allocation using data on aid flows (for example, Alesina and Dollar (2000) and Neumayer (2003)), this paper has no access to information on requests for TC since these data are not publicly-available. This data restriction could potentially affect the interpretation of some of the results. In particular, the effect of Board / AP membership may appear to be positive only for countries that are far from the US ideal point because those countries that share policy preferences with the US are less likely to apply for TC in the first place because they are relatively more advanced in the nuclear area, and are less likely to require the IAEA assistance. despite this restriction, it is important to note that some countries that are close to the US apply for TC and receive the IAEA assistance, and that TC is not limited only to those countries that are far from the US ideal point. The robustness checks presented here suggest that this finding holds even if we drop close US allies from the estimation. More importantly, the unavailability of data on TC requests does not affect the finding that countries whose preferences diverge from the US ideal point are more likely to receive TC when they serve on the Board or join AP. These results are based on comparison between BOG and AP members and non-members with the same policy preferences (i.e. far from the US ideal point). Unlike the US-friendly countries, there is no indication that countries with ideal points that lie far from the US preferences refrain from requesting TC. Furthermore, this data availability does not affect the results on the amounts of TC, since these tests focus only on countries that receive assistance.

Another potential caveat is the possibility that these findings are affected by the IAEA's particular circumstances. This raises the question of whether patterns from one organization are relevant for other IOs. It is impossible to answer this question using data from one organization. However, the dual role of the IAEA – its monitoring and developmental missions – suggest that the Agency may reflect dynamics of different types of organizations. The pattern with respect to assistance in health and agriculture may be similar to assistance allocation by such IOs as the World Health Organization or the Food and Agriculture Organization, whereas the distribution of sensitive aid may be more unique to the IAEA, or perhaps similar to such organizations as the Organization for the Prohibition of Chemical Weapons or the Comprehensive Nuclear Test Ban Treaty Organization. Moreover, the fact that the financial value of TC is smaller compared to the benefits allocated by the IMF can account for why proximity to the US plays a different role than it does in other IOs where it was found to be positively related to aid: countries that are not aligned with the US benefit from IAEA TC assistance because the economic stakes are lower, and the concessions that they provide are not as costly domestically as the concessions they make in the IMF or the WTO contexts.

Finally, the IAEA's key role in verifying compliance with nonproliferation commitments, and the Board's central position in deciding whether countries comply with these obligations make the IAEA BOG similar to the UNSC. Thus, similarly to the Security Council (Bueno de Mesquita and Smith, 2010), also here BOG members receive benefits when they serve in a position of power. All in all, comparison of these results to studies of other IOs suggests that economic and political factors can play a role, and that their precise role is also affected by the context and the type of IO, and that there is no single pattern that fits all organizations.

This paper also has implications for understanding the connection between TC and nuclear proliferation. Recent studies highlight the concerning link between civilian nuclear cooperation and proliferation (Fuhrmann, 2009*a*), and specifically the connection between receiving TC and developing a nuclear weapons program (Brown and Kaplow, 2014). In this context, the finding that some countries that do not have many common preferences with the US receive more TC may be worrying in light of the possible contribution of this assistance to their non-peaceful nuclear activities. However, my findings also show that these countries are more likely to receive TC and receive larger amounts of TC when they join AP, and this provides reassurance that TC recipients are likely to be subject to stringent nonproliferation safeguards. These findings also have a potential policy implication, in that TC assistance can be used to incentivize countries to accept additional nonproliferation commitments. That being said, it is important to keep in mind that many IAEA members, especially the developing countries, strongly oppose any explicit linkage between TC and nonproliferation. Finally, the findings here suggest that having a nuclear weapons program is positively associated with the likelihood of receiving TC. This result complements the finding in Kroenig (2009*b*) who reports a positive correlation between sensitive transfers and nuclear proliferation. Notwithstanding this correlation, it is important to note that there is some evidence that membership in NSG (an export control group) is positively associated with nuclear fuel cycle-related assistance[29], thereby suggesting that these countries are less likely to further spread their knowledge and capabilities without proper regulations.

Finally, this paper focuses on shared preferences between recipients and the US. The US is indeed a very influential player and the biggest donor to the TC program. However, it is worth noting that several other IAEA members share the US interest in nonproliferation, and that their position, as well as the IAEA's own standing and reputation on these issues support the US efforts to promote its nonproliferation priorities through the organization.

[29]The relationship between nuclear weapons program, NSG, and sensitive TC is significant at 10%,

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