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# COTS IMPACT ANALYSIS ASSESSMENT

**HOW TO DEMONSTRATE, MEASURE, AND ANALYZE IMPACT  
FOR THE CARIBBEAN OPEN TRADE SUPPORT PROJECT**

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FOR THE CARIBBEAN OPEN TRADE SUPPORT PROJECT**

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Michael Taylor, Cognizant Technical Officer**

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## INTRODUCTION

Impact analysis assessments are designed to carefully determine how impact, i.e. social or economic change that ultimately results from project activities, can and will be demonstrated, measured, and analyzed during the course of the project.<sup>1</sup> Impact analysis seeks to guide USAID in telling a credible and compelling story about project impacts on the societies and economies in the countries that USAID assists.

This report reviews the components of the COTS project in order to identify opportunities for impact analysis — where analysis includes the identification, measurement, and attribution and may involve simple data collection or more complex studies.<sup>2</sup> This report makes a variety of suggestions of specific measures and studies and of areas of further inquiry where impact analysis may be possible. (I am not a specialist in all of the technical areas covered by COTS, so my understanding or suggestions might miss the mark in some cases.)

This report is not intended to be prescriptive so much as to start the project team thinking and planning around impact analysis. The next step is for the project team to determine which analysis it wants to undertake and then identify and assign resources for those efforts.

This assessment explores a variety of ways to identify and assess impact. In some cases, there may indeed be a quantifiable indicator of impact, for which data can be collected on a periodic basis. In other cases, the project may be limited to case studies or individual interviews in order to draw direct links between project activities and the kinds of behavioral changes that we can call outcomes (as opposed to inputs and outputs). For all components, this assessment presents ways that the impacts can ultimately be monetized so that a return on investment indicator can be calculated.

A general conclusion in this report is that the project will only be able to measure and analyze impact in a comprehensive way if impact analysis is integrated into the project activities for each component. COTS is a complex project composed of a variety of activities, many with separate and distinct objectives. While a few possibilities exist for indicators that can capture impact across a set of activities, in many cases attribution will only be possible if project staff looks for ways to identify impact at the activity level. This will require follow-up efforts for activities; for example, interviews of training participants some time (say, three months) after a training to determine whether their behavior has changed consistent with the training. As noted above, some of these

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<sup>1</sup> The terminology in this report is based on a program theory framework with four stages: inputs, outputs, outcomes, and impacts. Outcomes and impacts are those changes that are not directly produced by the project but that result from the project's outputs. The continuum between outcome and impact is that between a more immediate result of a project output and the ultimate social or economic improvement desired. For example: the delivery of a training on better construction techniques is an input; a person who has received training (and therefore is presumed to have improved ability to construct a risk resilient structure) is an output; that person building a more risk resilient structure is an outcome; and the reduction (or avoidance) of damages during a disaster is the impact. This report considers both outcomes and impacts.

<sup>2</sup> This report only covers three of the four project components. I was informed upon arrival that the impact analysis for the biodiversity component would take place at another time.

analyses will not produce “indicators” but rather case studies or impact success stories that can still be enormously useful for the project to demonstrate impact.

An integrated approach will require all members of the COTS staff to be involved. The M&E specialist can assist by coordinating, monitoring, and compiling analysis, but each technical specialist will need to be involved in identifying impact and collecting data and information to analyze it. This need not be overly time consuming, and again, project staff will need to decide which impacts it wants to capture.

It should be noted that the measures considered in this report that can be monetized are, in most cases, not economic value-added indicators. That is, just because they are measures that can be represented in dollar terms (and therefore compared to the dollar cost of project activities), they do not necessarily represent increases in GDP. They should each be reported for exactly what they are and not summed unless otherwise recommended in this assessment.

### **Brief assessment of the Performance Management Plan**

For any project, the first place to look for impact indicators is in the Performance Management Plan (PMP). It is my understanding that the COTS PMP has evolved significantly over the life of the project. I have reviewed a draft version of the most recently revised results framework and indicators. The indicators, especially as defined by their means of measurement, comprise primarily input and output indicators. Those indicators that measure outcomes or impact include “Number of policy measures taken to improve the doing business environment through USG-assisted organizations as measured by improvement in the various category of the World Bank *Doing Business* report,” “Number of policies, laws, agreements or regulations promoting sustainable natural resource management and conservation that are implemented as a result of USG assistance,” and “Number of hectares of natural resources showing improved biophysical conditions as a result of USG assistance.” While these indicators do go beyond inputs and outputs, it is unclear in all cases how they will be measured and attributed accurately.

Based on the PMP, there is definitely scope to undertake impact analysis in addition to the monitoring and evaluation work currently underway.

## REDUCING RISK

As noted in the draft third work plan, “The current activities being undertaken by the Risk Reduction component are designed to improve the resilience of national economies to the shocks caused by the occurrence of natural disasters. The component attempts to achieve this by seeking to effect systemic changes in the way development plans are prepared by incorporating risk reduction measures in the planning phase... Additionally, the preparation of hazard maps in Dominica and the implementation of safe construction training activities in Antigua and Barbuda serve to ensure that current and future capital assets of the country will be protected.”

The program theory for this component is that efforts to improve the preparedness of countries for natural disasters will produce economic and social benefit through the reduction in or avoidance of damages from natural disasters. Experience around the world has shown that certain efforts made in advance of disasters can significantly reduce the damage caused by disasters and thus the resulting social and economic disruptions. Keith Ford explained that the ultimate objective of this component is to “establish a basis for sustainability in development.”

Project activities include those designed to reduce damages in specific ways (e.g. through better construction and better land planning and use) as well as a larger activity designed to influence governments’ (and organizations’) behavior such that they implement measures to reduce potential damages from disasters and respond better to disasters. This larger activity involves the benchmarking tool (BTool) that allows governments to self-assess their disaster preparedness.

Based on Ford’s statement, the ultimate desired impact from this project component is improved economic growth, which could manifest as higher rates of growth, more stable rates of growth over time, or both. Economic growth is affected by a variety of internal and external factors, however; the impact on growth from this project cannot be isolated. The intermediate impact of increased preparedness is reduced costs from disasters, i.e. from reducing the damage that a disaster can cause and improving the response. The monetized measure of the intermediate impact is the expected value of the damages from a natural disaster before the project minus the expected value of the damages from a natural disaster after the project. This indicator measures the benefit of the project as a savings.

I spent some time looking into damage assessments and the methodologies, as well as looking for studies that might show what kinds of savings preparedness measures can generate. While there are several methodologies for assessing damage, unfortunately, far too many variables are involved to estimate the expected value functions suggested above. The estimates of total damage vary considerably by country, type of disaster, and severity of disaster. The potential reduction in damages varies considerably by type of preparedness measure and also by the type and severity of disaster. Studies for countries such as the United States are hard to apply because the type and value of properties and infrastructure are so different.

In this report, five types of measures or analyses are suggested that the project might consider for demonstrating impact: expected value of damage estimates at the activity level, expected value of damage case study, insurance, expenditures on preparedness, and BTool outcomes over time.

### **Expected value of damages at the activity level**

The project could calculate estimates using the same theory as above (i.e. expected value of damages before the project minus expected value of damages after the project), but at the activity level rather than universally for the country. This approach would reduce tremendously the number of variables that need to be guessed. Assuming that the estimates of different activities are made using consistent methodology, these could then be summed. This sum would be a lower-bound measure of the benefit, as there are likely positive effects (e.g. spillover effects) of the project on preparedness that cannot be captured and measured.

For example, Keith Ford's case study cited in the *Building Capacities for Risk Reduction* training manual shows that construction retrofitting can reduce damages to homes from a hurricane significantly. Where the project now is assisting with the same retrofitting, the benefit could be calculated as:

Number of retrofitted houses \* ((average construction value of home\*(percent damage before retrofitting – percent damage after retrofitting) – average cost of retrofit)

That is, suppose that the average house costs \$20,000 to construct. Before the retrofit, we predict that the house would likely be 90 percent destroyed by a hurricane — meaning that it costs \$18,000 to reconstruct the house. After the retrofit, we predict that the house is likely to be only 10 percent damaged by a hurricane, meaning that the necessary repairs cost \$2,000. The damage percentage predictions would be based on past experience. If the retrofit costs \$1,000, the benefit would be \$15,000. Instead of a single estimate, one could use a range of values to reflect that the percent damage will depend on the severity of the next hurricane, which cannot be predicted.

One could also report expected value more accurately by introducing a probability that a damaging hurricane does occur during the life of the house (or life of the retrofit). That is, suppose we believe there is a 50 percent chance that a hurricane will occur in the next 20 years. Then we could estimate the expected value of the benefit as \$7,500.<sup>3</sup>

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<sup>3</sup> This calculation is oversimplified since it does not account for time. The retrofit expenses are incurred immediately, while the hurricane (and thus the damage costs saved) will happen sometime in the future. Thus, theoretically, the benefit should be discounted over some period of time. It is also the case, however, that the construction value of the house is likely to increase over time, so although future values should be discounted to the present, those future values are also likely to be higher in nominal terms. In addition, it makes a difference to the total benefit whether the repairs to the retrofitted house include bringing the house back to retrofitted condition. If so, then the initial retrofit cost — \$1000 in this example — is spread across all future hurricanes, thus increasing the benefit. Given that the discounting damages to present value from the first hurricane would decrease the benefit estimate but the addition of future hurricanes would increase the benefit estimate, it is probably safe to simply use the equation above where time is ignored.

This measure involves a lot of guessing. Its feasibility would depend on the collection of data (or guesses) at the activity level and then summing them later, paying careful attention to the expected values and double-counting. If it can only be estimated with any degree of credibility for a small number of project interventions (e.g. just for housing retrofitting, since we have past experience with the effectiveness of these retrofits against hurricanes), project staff may wish to simply estimate and report it at the activity level for those activities, and then, if desired, use the project's cost for that activity in order to make a "return-on-investment" comparison.

### **Expected value of damage case study**

Another possible avenue to reporting impact in terms of reduced expected value of damages would be to do a one-time study near the end of the project based on actual past disasters and their damage assessments. This could only be done for Dominica and Grenada, for which actual damage assessments exist. The methodology of the study would be to take the damage assessment for the past disaster and, for each (or for selected) calculation(s) within the assessment, estimate how the damage would be different based on the current preparedness of the country, and then recalculate the total value of the damage. The impact could then be reported as "the increase in preparedness in country X would reduce the value of damages from a disaster identical to the past disaster in the range of A percent to B percent." This estimate would not be a forecast of the future, but rather an indication of impact relative to a known baseline.

Although this study would require much guessing in terms of how the damage would be different (e.g. determining that destruction would be reduced from 90 percent to 10 percent), it would have the advantage of taking other variables, especially many of the actual and shadow prices, directly from the previous damage assessment. The analyst might want to update these figures if better data or assumptions are available. It would also make the guessing easier because it would give the analyst a "fixed" disaster against which to guess. That would also mean that certain improvements would not affect the estimate from this study, if the earlier disaster did not affect the areas where those improvements have taken place.

In sum, a study like this would not measure the project's full impact, but could be a relatively easy way to tell a story about impact in terms of expected value of damage using an understood baseline. The study would likely take a few days to complete, but would only be conducted once.

For either or both of the two suggestions above, it could make sense to hire a consultant from one of the agencies routinely involved in conducting damage assessments. This participation would ensure that the methodology is applied correctly and that the guesstimates are consistent with normal applications. It has also been suggested that there are some good case studies for Japan of the difference that preparedness can make in damages from natural disasters.



## Insurance

The market actually monetizes risk through insurance, so insurance premiums and/or coverage levels should provide a useful indicator of changes in expected damage. In the case of the COTS countries, the incidence of insurance coverage may be a more appropriate indicator, since many properties are not currently covered, and these properties are likely to be the ones in most need of COTS assistance. Some of the COTS activities are directly intended to reduce expected damage so that insurance companies are willing to cover more properties. Increased insurance coverage not only indicates that expected damages are lower; it should also represent an increase in welfare, as inhabitants feel much better both before and after a disaster knowing that their properties are covered by insurance.

The question is whether acquiring data on insurance coverage it is possible, either at the activity level or universally for each country. If the data exist, possible indicators are: the value of property in the country that is covered by insurance, the percentage of property in the country that is covered by insurance (although this does not make much sense unless the percentage is in value terms), and the total coverage amounts for the country (i.e. the sum of the maximum coverage amount for each property covered). Indicators that would be more attributable include the value of property newly covered by insurance and the total coverage amounts for properties newly covered by insurance.

Even if insurance data are not available, engaging insurance personnel in the measurement of impact for the project could be useful. Insurance assessors/adjusters are trained to estimate expected damages in order to determine premium and coverage amounts. Project staff might consider hiring an assessor to provide estimates of the changes in expected value of damage for properties or areas directly assisted by the project. Not only would these specialists have the knowledge to develop good estimates, but this could be an indirect way to inform and interest the local insurance industry in the work of the project.

The BTool may provide data for an insurance indicator. Question C1.7 asks, “Do the risk transfer instruments cover the majority of public assets?” and C1.8 asks, “Do the risk transfer instruments cover the majority of private assets?” These risk-transfer questions encompass more than just insurance, but should still be a good indicator that the value of expected damage has been reduced enough and/or is now predictable enough that the risk can be transferred. And the welfare effect will be the same. Simply capturing whether a country has gone from not a majority to a majority would not be very informative. Instead, the project would want to collect the source data for the tool that would, hopefully, give some kind of percentage of coverage. These data are still likely to be rough, but could be expressed in ranges, e.g. “the percentage of public and private assets covered by risk transfer instruments has increased from an estimated range of 20-30 percent to an estimated range of 50-60 percent.”<sup>4</sup>

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<sup>4</sup> Monetization would require an estimate of the total value of the properties covered. With these data, one could report that project efforts have increased the value of private and public property covered by risk transfer instruments by \$X million. However, credible data for these values are likely hard to get.

## **Expenditures on preparedness**

Public and private budgetary allocations for disaster preparedness expenditures is a monetized indicator that could serve as a proxy for impact. There is a problem with interpretation, however. On the one hand, the project seeks to increase government and organizational efforts for preparedness, so the impact should be that budget allocations increase. On the other hand, if preparedness measures are effective, the necessary budgetary allocations for recovery expenditures should fall. If the budgets are fairly detailed, these distinctions may be clear, which would make an indicator using these figures possible. That is, the indicator would be the increase in budgetary allocations to disaster preparedness.

Related to the budget allocations indicator, another possible monetized indicator is investment in preparedness. Like the budget allocations indicator, this measure would capture an outcome that proxies for impact but is not the ultimate intended impact. That is, we assume that the increased investments lead to decreased damages, so increased investment is an outcome indicator that proxies for the impact. Like the expected value of decreased damages measure discussed above, this would be a cumulative indicator for which data would need to be collected for each project activity. It would be more straightforward than the damages impact indicator because there would be much less guesswork. That is, rather than guess that the damage without the retrofit would be \$18,000 and the damage with the retrofit would be \$2,000 and the probability of a hurricane is 50 percent, an investment indicator would simply take the observed value of the retrofit investment — \$1,000. This could be multiplied by the number of houses and then added to the dollar-value investments in preparedness from other project activities.

Assuming that no double counting is made, these specific investments could be added to the increase in budgetary allocations for preparedness (but not for recovery), since that also represents investment in reducing the cost of damages from disaster. This indicator could be reported in terms of return on investment (i.e. an investment return on investment) if the project costs can be disaggregated.

When considering the expenditures/investment indicators, it is important to keep in mind that there are not likely to produce big numbers. That does not mean that the potential impact is not great, but that unfortunately, these proxy indicators will not themselves yield big numbers.

## **BTool outcomes over time**

Given the benchmarking tool activity, a possible indicator of project outcomes in this component is the change in the score on the BTool over time. That is, the score on the BTool is meant to be an index of preparedness, so the project can examine the change in this index over time.

This indicator has a few advantages: it measures and aggregates across a wide variety of preparedness efforts, all of which are meant to be influenced by the implementation of

the tool; it is theoretically a consistent indicator across different countries; it is meant to be measured once a year; it is already numeric and thus feels like a quantified measure; and it is already being implemented by the project.

This indicator has some disadvantages as well. First, although the value of the indicator is numeric, it is meaningless in and of itself. We do not have any way to understand intuitively the difference between 47 percent (the current score for Antigua and Barbuda) and 52 percent (the current score for St. Vincent and the Grenadines) or to understand what it would mean if Antigua and Barbuda improved from 47 percent to 52 percent in a year. Second, the value of the indicator does not lend itself to monetization. Third, the lack of analysis supporting the three assessments done to date suggests that the understanding and use of the tool is still developing. Thus a year-to-year change in the value of the indicator could simply reflect an improved understanding of how to use the tool and not an actual change in a country's preparedness.

Regardless of these disadvantages, if the countries COTS is assisting do show an improvement in their BTool scores over time, the BTool scores could serve as an outcome indicator, i.e. an indicator of preparedness outcomes influenced by the project. For attribution, it will be important for the project to produce evidence, even if only anecdotal, that at least some of the efforts that contributed to the improvement in the score were undertaken in response to the BTool itself and not otherwise planned.

The project should not try to conduct return-on-investment type analysis (i.e. with the change in the BTool score as the return, and the project costs devoted to the BTool activity as the investment), because the primary investments in improving preparedness are coming from the governments and organizations themselves. In fact, a more appropriate return-on-investment measure for the BTool activity would be a sum of government and organizational investments in improving preparedness in the numerator (at least those that were motivated by the BTool) and the project cost for the BTool activity in the denominator. The indicator would be the investments in preparedness generated by the project.

The BTool itself may provide more useful indicators of impact if some of the questions within the tool and/or the information supporting the answers to those questions are analyzed independently. For example, if the countries have completed risk assessments and/or vulnerability assessments, and these assessments are updated during the course of the project to reveal improvements motivated by the project, then the information from the assessments could be used to demonstrate impact. However, apparently the assessments that have been completed to date are not quantitative, so the information likely cannot be monetized.

Assuming that the expected outcomes of the BTool are to make governments more aware and better informed as well as to induce them to undertake preparedness efforts, the responses to the BTool could be used to disaggregate these outcomes. An analysis of responses could show the number of cases where the government improves from a "no" to a "planned," which might be interpreted as an increase in awareness; and the number

of cases where the government improves from “no” or “planned” to “yes,” which is indicative of efforts actually undertaken.

In addition to the five approaches examined above, project staff should also consider some impact “story-telling” at the activity level. One important project activity is the development of hazard maps and the promotion of better land-use planning. The best way to report impact for this activity might be simply to tell an impact story about how planners are using these maps and making decisions based on them. Perhaps a quantitative indicator could be the ratio of the value of new construction in safe areas to the value of new construction in non-safe areas. Even rough historical data could help establish the direction of change during the project. This indicator has a problem, however — if an investor knowingly builds in a non-safe area, he or she should be expected to spend more on construction in order to be more prepared for a natural disaster.

## GOVERNANCE

The governance component lead, Deborah Hackshaw, identified two primary areas of activity under this component: investment promotion through the investment promotion agencies and trade facilitation through work with customs. The project is taking on a variety of distinct activities to improve governance and improve the business climate across the different countries. Monetizing the impact from improved governance is difficult to begin with, but the variety of distinct activities makes it more difficult, given that the manifestation of the economic impact for each activity can be different.

This assessment will consider first the impact measurements for business climate and investment promotion, then consider impact measurements specifically for trade facilitation.

### **Business Climate Reform and Investment Promotion**

In general, the program theory behind the business climate and investment activities is that investment promotion activities will reduce the cost of investment, and business climate reforms will both reduce the cost of investment and increase the benefits from investment, thus inducing greater domestic and foreign investment in the economy. Investment should lead to greater economic growth and thus increased household income and increased government revenues. Investment is then an outcome indicator that proxies for the ultimate impact.

One possibility for measuring the increase in investment would be to use national statistics on investment. So far, however, national statistics on total investment have not been found. The most recent IMF statistical appendix for Antigua and Barbuda has values for net foreign direct investment for 2000-2005. These figures jump around quite a bit from year to year during that period, however. Assuming that external shocks to this small economy continue to make the numbers jump from year to year, attributing project activities to any changes (positive or negative) at this level of aggregation is not feasible. How frequently these series are updated is also unclear, i.e. whether we will have even 2008 data by the end of the project in 2009. I have not seen any statistics yet for domestic investment, although the IMF does present some data on credit. Project staff are recommended to collect whatever national statistics on economic activity are available. In the least, it is important to know what is going on in the aggregate in order to interpret impact measurements at the activity level.

While the project may not be able to estimate impact on aggregate, there should be opportunities to measure and analyze impact at the activity level. Hackshaw reports that the investment promotion agencies (IPAs) assisted by the project are supposed to implement investor tracking systems. These systems should be collecting data on the value of investments that are facilitated by the agency. Of course, whether the investment would have occurred (or at what value the investment would have occurred) without the IPA is unknown, so an increase in investment facilitated by project activities cannot be reported. But we can report that a certain level of investment was facilitated each year by the IPAs, which were assisted (and in some cases established) by the project. Investors

could also be asked to give a rough estimate of what would have happened without the IPA, but that information would be more anecdotal than empirical.

Project staff are recommended to work closely with the IPAs to help them develop their investor tracking systems, to make sure that the appropriate data are being collected, and to see that the data collection procedures ensure credible and consistent data.<sup>5</sup> It might make sense for the M&E specialist to be heavily involved in this activity so that the data collection through the IPAs can be similar to the FIM for the private sector development component. The project or IPA might need to work directly with the firms or investors in some cases to help them estimate and report the right number. Particularly in the case of large investments, this effort should benefit more than the project as accurate reporting of the role that the IPAs can play will be important for these agencies to continue to secure government funding.

Other specific activities to improve the business climate include improving land management, improving business registration, and targeting *Doing Business* indicators. Impact measurements for each in turn are considered here.

#### **LAND MANAGEMENT**

The project has worked in Dominica to improve the processes of land management and administration. Assuming that under the new administration, the government collects and maintains statistics on the value of land transferred during the year, this statistic can serve as an outcome indicator for the project. An increase in the value of transferred land directly reflects an increase in economic activity and indicates (but does not measure) value added, since we assume that land transfers in a market economy are made in order to increase the productive capacity of the land. Put simply, new owners can afford to purchase land from previous owners because they can use the land to produce greater value than the previous owners. The indicator would be reported using language such as, “the project’s activities assisting land management and administration led to a \$[X] increase in the reallocation of land resources in the economy.”

#### **BUSINESS REGISTRATION**

The project is conducting some activities under this component that are intended to improve the business registration process. The program theory for this reform is complex. In many countries where business registration takes a long time or is costly, the negative outcome on the economy is that businesses operate in the informal economy, and this creates costs in a variety of ways. That does not seem to be the concern for the COTS countries, though. It seems that the desired impact for the COTS countries is increased investment and increased business activity. The empirical evidence that improving registration procedures contributes directly to an increase in business activity (or entrepreneurship) is weak. The project could try to collect data on the number of registrations year to year. To claim any impact, we would need historical data in order to show that the increases in registrations after project activities concluded were greater than

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<sup>5</sup> For example, it will be important to carefully define investment for the purpose of collecting data from firms. A sample query would be: Does the number include the value of existing capital that is repurposed for the new activity? The IMF should be a good place to look for how investment can be defined and how data should be collected.

typical year-to-year increases. There is still a big problem with attribution, however, given that increased business registration (particularly if it is not a one-time formalization of informal businesses) is going to be caused much more by other improvements in the business environment and by investment promotion. The measured increase would be caused by a large variety of factors, not just by easier registration. It might make more sense to claim that the investment coming through the IPAs is partly attributable to the improvements in business registration and thus the impact is captured by the IPA indicator.

To look more closely at the new registration agencies, the project could attempt to collect data directly through the institutions assisted. As with the IPA data, these data would not be able to tell a story about impact in terms of a change or increase, but they should be able to tell illustrate how many businesses and entrepreneurs are using the facilities assisted by the project.

### **DOING BUSINESS INDICATORS**

During the period of the COTS project, the COTS countries, with project assistance, have been added to the World Bank/IFC annual *Doing Business* surveys. The project documents mention that, as a result, the COTS countries are starting to focus directly on reforms intended to improve their *Doing Business* indicators (e.g. see Objective 5 in the Draft Third Work Plan). Project staff have noted in meetings, however, that the somewhat arbitrary nature of the relative changes between COTS islands from the 2007 to the 2008 indicators has caused some skepticism in several of the governments. To the extent that reforms do target these indicators directly, the project can certainly use these indicators as outcome indicators that proxy for economic impact. These indicators have the advantage of already being quantified, although they typically are not monetized. The trading across borders indicators will be addressed in detail below.

### **QUANTIFYING AND MONETIZING**

In theory, any of the monetized indicators above can be reported in terms of return on project investment as long as the numerator is presented for what it actually is and the project costs can be disaggregated by activity (e.g. “through the IPAs, the project facilitated \$[X] million of investment in Antigua and Barbuda in 2008 using only \$[Y] thousand in project resources”). Obviously, the government also helps to finance the IPAs, so the actual investment to yield the return involved (i.e. costs associated with attracting new investment) are greater than just the project resources expended.

In the case of investment, a much more important consideration (or caveat) should be kept in mind in reporting return on investment: the financial incentives to investors provided by the government. It seems that at least some of these governments are rather heavily involved in providing investment incentives. These are, of course, real costs to the economy, and if we wanted to use the increase in GDP from the investments as our impact indicator, we would need to account for the government expenditures (including tax expenditures) in the denominator. Given that we are not using GDP for the impact indicator, and if we assume that the government has ensured that the incentives will ultimately be revenue neutral, then we can simplify and report the amount of investment

facilitated by project resources or project resources plus government support of the IPAs.<sup>6</sup>

Given the difficulty in measuring project impact in the aggregate, it will be important to analyze impact and report impact stories at the activity level, particularly for key activities. One primary example in which quantifiable impact indicators are difficult is the policy analysis work produced by the project. In that case, project staff may interview government officials after the delivery of a policy study (such as the trade study) to see whether these officials report that their level of understanding and intended actions have changed as a result of the study.

What is important for case studies of impact is that they focus on outcomes that result from project efforts but are not produced by the project. For example, the number of studies produced is an input, and the number of government officials who receive and even who read an analysis is an output. The outcome occurs when the government official changes his/her behavior (and in a positive way) due to the analysis. Obviously, conducting impact analyses for each activity in the governance component will not be feasible, but conducting some impact analysis will be important, in order to demonstrate that the project activities yield outcomes that are expected to contribute positively to the desired impact.

### **Trade Facilitation**

The program theory is that if the costs of trade are reduced, the prices of imported goods should fall and the costs of export goods should fall. The decrease in import prices should increase the welfare from the consumption of imported goods and should reduce production costs for sectors where imported goods are production inputs. The decrease in the costs of exporting goods should allow the country to export more goods, which directly benefits GDP.

How can we think about the costs to the economy of constraints on trading across borders? The *Doing Business* indicators focus on three types of costs: the dollar costs of complying with trade regulations (excluding customs duties); the number of procedures necessary to trade, which can be translated into administrative costs; and the time in days it takes to complete different stages of trade. The time may be translated into direct costs, such as storage costs (other than official terminal handling charges) that must be paid while goods are awaiting clearance or administrative costs associated with time distinct from those associated with the number of procedures. In addition, the time value of money is a direct cost from longer trade times. It is likely, however, that the more significant costs of time come from depreciation. Depreciation here can include any reason that a good becomes less valuable over time, such as spoilage and changes in preferences/demand. In addition, time to trade imposes costs on some firms by causing

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<sup>6</sup> The assumption that the government has performed the analysis to ensure that the investment incentives are ultimately revenue neutral is a mighty assumption. But it would be very complex for the project to undertake that analysis on its own.



them to hold larger inventories of goods than they would otherwise in order to buffer against uncertain arrival or departure of future shipments.<sup>7</sup>

A recent USAID study calculates tariff-equivalent parameters for the cost of trade time across countries. These parameters are estimated using firms' choices to transport traded goods using air transport instead of sea shipment, thus the costs that are captured are just those associated with time alone. These parameters do not capture administrative costs incurred at borders and they do not capture other institutional costs.

What are the other institutional costs? The customs advisor for COTS argues that the real costs to the economy for Antigua and Barbuda from the current customs regime do not arise from the direct costs associated with the procedures or time delays so much as from the institutional features of the regime that allow for a great deal of corruption and maneuvering — both of which are highly distorting to the economy.

The customs advisor identified four ways that imports are processed in Antigua and Barbuda.<sup>8</sup> In the first case, all the regulations are followed by the book, meaning there are delays and all duties and fees are paid at the time of import. This case affects many of the smaller importers. In the second case, some importers have the privilege of not paying the duties until the end of the year. In the third case, some goods are released very soon after arrival (i.e. the delays are avoided) for some importers. These shipments may have minimum documentation, and these importers drop off an invoice for the goods along with a “check” to customs for the expected duties and fees. A customs officer is then supposed to inspect the goods at a later time, on the importer's premises, in order to assess the duties and fees. Again, this case applies to privileged importers and is important for the import of perishable goods into Antigua and Barbuda. In the fourth case, a set of importers has an arrangement with customs to use an “exchange of check” in order to both delay payment of duties and fees to the end of the year and to barter these liabilities against purchases that the government makes from these importers. Payments are not made throughout the year and these liabilities are balanced at the end of the year by one person. There is no auditing of these balances.

These cases are described in order to consider what the larger costs to the economy are of the institutional regime and thus what the possible benefits are from reforming it. The situations described above will mean that importers who have these privileges will enjoy lower costs of business. Those who get their goods out of customs faster have less depreciation. They may also be able to charge higher prices because they get their goods to consumers before others and thus face less competition. The importers who can pay their duties at the end of the year, even if they pay the legal amount, enjoy lower costs by delaying the payment of these amounts.

In market economies, differential costs across firms providing or producing the same goods cause the firms with higher costs to fail and thus reduce the number of active firms

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<sup>7</sup> See David Hummels, “Time as a Trade Barrier,” July 2001 and USAID, “Calculating Tariff Equivalents for Time in Trade,” March 2007 for a discussion.

<sup>8</sup> For Antigua and Barbuda, the vast majority of trade in goods is imports, so this discussion will focus on imports.

in the market. As the number of firms decreases, competition is limited and the prices of goods will increase. In short, differential costs across importers reduce competition in the economy, causing prices to be higher than otherwise and likely also limiting the quantity and diversity of goods.

In addition, the presence of these privileges and the likely corruption associated with them suggests that customs duties and fees revenues are be much lower than they should be given customs policy and the actual mix of goods traded.

These institutional costs, while not directly caused by time, are likely to be highly correlated with time. A government official has a greater opportunity to solicit a bribe if the goods are held up for some time, and the importer has a greater incentive to pay for privileges if the goods can be held up. Reforms designed to reduce the time to trade are thus highly complementary with reforms designed to directly reduce institutional costs. Thus, the indicator for time to trade can be used to measure some impacts directly as well serve as a proxy for additional benefits.<sup>9</sup>

Based on this understanding of the effects of the customs administration regime on the economy, four ways of measuring impact from trade facilitation are considered.

#### **COST INDICATOR**

First, the project could construct a cost indicator. The reduction in measured costs of trade over time would represent the savings generated from project activities. Costs can be measured on the business side, the government's side, or both. The methodology for this would be based on standard administrative costs methodology. To be credible, the cost indicator needs to be based on actual data from importing firms (including actual costs incurred and the prices or shadow prices of those costs), which could be collected as part of the time survey being implemented by the project.

On the business side, the costs could include labor costs (employees' time necessary to clear goods through customs multiplied by their wages), compliance costs (e.g. port authority storage charges), and real depreciation costs (e.g. percent of goods that spoil while awaiting clearance).<sup>10</sup> The benefits from the cost savings in the first two cases come from reallocations. That is, firms save money but others (employees and the government) lose money, or firms do not reduce labor costs but reallocate the labor to other uses when trade administration is easier. Lowering the third cost, that is, reducing the depreciation of goods, is a "real" benefit to the economy in the sense that there is more value added than before.

On the government's side, the costs saved would be primarily the labor time and materials costs of implementing the old customs regime minus the time and material costs of implementing the new regime. Again, the indicator should be based on actual

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<sup>9</sup> It is likely, for example, that the Djankov, Freund, and Pham estimates pick up some of the correlated institutional costs.

<sup>10</sup> See "Focus on Administrative Burdens! Guide for defining and quantifying administrative burdens for businesses," Legislative Burden Department, Ministry of Finance, The Hague, Netherlands, December 2003.

data collected from the government, even if somewhat informally. If a cost indicator is reported for the government side, it is important to account for the administrative costs of the new regime. It may very well be that even though labor time is reduced, materials costs (such as the operation and maintenance of an electronic system) are higher. If cost savings are reported, they need to be net administrative costs from the old system to the new system.<sup>11</sup>

#### **CHANGE IN VOLUMES AND WELFARE**

Second, the project could use the time data and the tariff-equivalent calculations to estimate the change in import volume and the change in welfare (consumer surplus) from the consumption of imports due to the reduction in trading time. The customs advisor explains that trade delays for exports is not a significant issue for Antigua and Barbuda because the bulk of exports are tourism, which are not physically transported through customs. The methodology for estimating the gains for imports is included as an appendix to this report. The methodology makes very simple assumptions about supply and demand elasticities in order to calculate estimates without having price or quantity data. The data the project would need to calculate these estimates are total value of imports in the first year and the reduction (that can be attributed to project activities) in the number of days to get the goods to their final destination.

#### **GOVERNMENT REVENUES**

Third, the customs advisor suggests that the greatest benefit from improving customs administration in Antigua and Barbuda will be an increase in government revenues from customs duties and fees. In other words, as explained above, one of the greatest problems with the current system is the opportunity for distortion, delay, and corruption in the payment of duties and fees. Thus, impact indicators for the project work in this area should include collections data on import duties and fees. These data need to come from the government, and I do not know how accessible or reliable these data are. It may be that the “post” numbers are very reliable as they are generated by new computerized processes, but that the baseline data are rough.

Even so, a comparison of these numbers should indicate a significant and important benefit. The benefit is a reallocation, since these payments come from businesses, but a government’s ability to consistently collect revenues is necessary for its effective functioning. In addition, more equitable payment of duties and fees across firms should level the playing field and benefit the overall economy. See below.

The problem with using the government data on collections as a project impact indicator is attribution. If the government or other donors are making additional changes to improve trade facilitation, then the project cannot claim to have caused the full increase in duties and fees collections. Assuming that the project’s contribution has been important to the overall changes, however, it is fair to report something along the lines of

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<sup>11</sup> It could easily be, for example, that administrative costs for the new system are higher than before, but this is still a good government investment because duties and fees collections increase by much more and there are greater benefits to the economy.

“project activities contributed significantly to a \$[X] million increase in government revenues from duties and fees.”

#### **MARKET CASE STUDY**

Fourth, as discussed above, in the case of Antigua and Barbuda, the anecdotal evidence suggests that there the current customs administration regime is harming the economy in more ways than just slowing the arrival of imports to their final destination. The current regime creates distortions in the economy that likely lead to reduced competition, which leads to higher prices and lower quantity and diversity of goods, both for consumers and for producers who use imported goods as inputs. It is not straightforward to measure the impact of reduced distortions, however. The invisible hand is, after all, invisible. Project staff are recommended to conduct one or more case study of import sectors that are highly influenced by the current regime in order to demonstrate and analyze the impact from improving it.

The customs advisor suggests that cars might be a good sector to study. Such a study could be conducted by following the basic steps below:

Before the changes:

1. Describe the current market for cars in A&B in order to show that competition is limited.
  - a. How many sellers/distributors?
  - b. How many models/varieties?
  - c. How many sold in a year?
  - d. What are the price ranges?
2. Analyze how the current customs administration regime benefits the incumbent sellers of cars.
  - a. What privileges do car sellers enjoy?
  - b. How might these privileges reduce their costs?
  - c. How might these privileges reduce their competition?

After the changes:

3. Describe the changes in the customs administration.
4. Provide at least anecdotal evidence that these changes have impacted car importers, e.g. car importers who had used the “exchange of check” system can no longer use it.
5. Describe the new market for cars in A&B hopefully to show that competition has increased.
  - a. How many sellers/distributors?
  - b. How many models/varieties?
  - c. How many sold in a year?
  - d. What are the price ranges?
6. Discuss possible exogenous factors.

Ideally, the case study will show that the number of sellers has increased, or at least that the number and variety of cars sold has increased while prices have gone down (or increased less than overall consumer price inflation). There may be other signs of increased competition between sellers as well. While such a case study would take some time and would not yield an indicator, it would demonstrate impact that reaches the everyday Antiguan and Barbudan citizen.

## PRIVATE SECTOR DEVELOPMENT

The demand-driven approach to private sector development, which essentially demands impact as an output, presents a bit of a conundrum for impact measurement. According to the approach, sales and employment are output indicators of the project — the project interventions are targeted at making a particular transaction occur or to achieve a particular level of sales and employment forecasted by the firm in advance. As an output indicator, we measure sales and employment for those firms directly receiving assistance from the project.

Ultimately, the goal of private sector development is growth across enough firms and industries that overall sales increase (i.e. GDP growth), employment increases, and poverty falls. Indicators of those impacts at the national level help describe the overall environment, but they are too broad to be attributable to project activities and thus are not useful for demonstrating impact at the project level. Ideally, the program theory for how the demand-driven approach leads to GDP growth should help us identify outcome indicators that can proxy for broader, sustainable impact.

My reading of Riordan's draft manuscript *We Do Know How: A Buyer-Led Approach to Reducing Poverty* reveals several linkages between the individual transactions and broader private sector development. They include (but no doubt are not limited to):

- Productivity gains from technological improvements, which allow the assisted firms to continue to produce more efficiently in the future
- Increased market size, due to improved information, that allows assisted firms to sell more in the future
- Reduced costs and/or productivity gains from improvements in value chain linkages, which allow assisted firms and those in the value chain to produce more efficiently in the future
- Value chain multiplier effects, i.e. firms in the chain benefit from the firm's increased sales and/or reduced costs, independent of whether the other firms have any productivity effects
- Copycat gains, i.e. non-assisted firms experiencing any of the gains listed above through copycat effects
- Aggregate demand multiplier effects, i.e. increased employment or wages in the assisted firms have an impact on aggregate demand through expenditures for employees

We could consider indicators for each of these intermediate outcomes, but not all of the project interventions will contribute to all of the outcomes. For example, one intervention may not change the production function of the firm at all, but instead just grow the market that the firm serves given its current technology. Some of the outcomes above may be difficult to observe, such as copycat gains or productivity changes in non-assisted firms. There are also advantages and disadvantages to the indicators that we might use for some. For example, total factor productivity can be difficult to calculate.

In spite of these difficulties, I believe that we do need to identify one or more intermediate outcomes that are most relevant for, and can be observed for, this project and find a way to measure them. Put very simply, the sales and employment indicators for the assisted firms are the parts, and we need a way to show that the whole is greater than the sum of the parts. Given that the program theory is Riordan's and that he is closely involved with the project, it is best that he take over in identifying the impact indicators for this component.

Project staff are recommended to continue to carefully collect and report the sales and employment data from the assisted firms. Keep in mind that the employment indicator should be interpreted carefully, as sometimes improvements in productivity require decreases in employment or turnover in employment (i.e. changes in skill mixes).

Also, project staff are recommended to consider collecting the following indicators:

#### **INVESTMENTS**

Project staff should work harder at collecting investment data from the firms. Certainly these data have problems, but investment does go a bit further in terms of indicating something longer term than a specific transaction or a single sales target.

#### **WAGE BILL**

In order to apply an aggregate demand multiplier and calculate an aggregate demand effect, the project would need data on wages as well as employment, or more simply just the data on the total wage bill of assisted firms over time. Even without applying the multiplier, those data give a better idea of how the benefit of the specific intervention is being spread throughout the firm — if profits increase and the wage bill does not, the intervention is not likely to have a big impact on poverty.

#### **MATERIAL EXPENDITURES ON LOCALLY SOURCED INPUTS**

Even without going to the trouble to try to calculate multipliers along the value chain, it could still be useful to collect data from the assisted firms on how much they spend on locally-sourced inputs to give some indication of the broader impacts on the local economy the project interventions are having.

#### **NEW TECHNOLOGY**

Without going through the complicated process of calculating total factor productivity, project staff could still identify the cases (in a more anecdotal way) where its interventions did introduce new technology. Further, it could look for anecdotal evidence of copycat effects. For example, the advisor described how the project introduced improved food service technology in one resort in Dominica and then observed that other resorts hired the same consultant. With decent anecdotal evidence, the project might then aggregate in the following way: “the project introduced new technologies in the [X] sector of the economy, which accounts for [X] percent of the total economy, or \$[X] million in annual sales.” Staff need to be careful not to take credit for those total sales and be clear that the project “footprint” is being measured instead.

## **ANNEX A. MONETIZING THE BENEFITS FROM REDUCING TRADE TIMES**

The methodology presented here draws on research published by USAID that estimates tariff equivalents for the cost of time delays in trade. The paper, “Calculating Tariff Equivalents for Time in Trade,” published in March 2007 is based on an approach developed by trade economist David Hummels in his July 2001 paper, “Time as a Trade Barrier”. The approach uses the time and price difference of air vs. sea shipment for international trade to estimate how valuable it is to traders to reduce shipment times for a broad range of goods. These values are estimated as percentages of the values of the goods traded and thus can be thought of as similar to reducing tariffs on those goods. The value of reducing shipment time arises from the various ways goods can depreciate over time as well as from inventory costs born when shipment times are long or uncertain.

Although these values are estimated based on shipping choices, the depreciation and inventory costs from trade times are the same whether the time is during shipment or at the border. Thus we use these estimated values as tariff equivalents of the time at the border as well. In fact, these estimated values are quite likely under-estimates, or lower bounds, of the costs to traders incurred during the actual time that a shipment is going through customs.

These values cannot be used to represent the costs of time for document processing before the goods are loaded for export or document processing time for imports that overlaps with time that the goods are already in transit. Thus it is important when using this methodology that the decrease in trade times used for estimation only include those when the goods are in transit, either in shipment or at the border. So far we do not have the *Doing Business* indicators disaggregated across the four time categories for any year other than 2007 (i.e. in the *Doing Business 2008* publication), so we must make extra assumptions in order to apply this methodology to the *Doing Business* time data.

As noted above, the USAID approach is based on the differences in shipping preferences across different types of goods. It calculates tariff equivalent estimates per day for each country by applying the estimates by goods to the composition of imports and exports for each country. Over time, we expect that the composition of imports and exports will change for each country, particularly for those countries that experience notable improvements in trade facilitation. In fact, as trade facilitation improves, the mix of goods is likely to include more goods that are time sensitive, which will cause the tariff equivalent cost of one day of delay to increase.

Table 1 presents the calculated tariff equivalents for each country and for each country’s region for imports and for exports based on 2003 trade data.

### **Imports**

For imports, we can estimate the increase in import volume and the increase in welfare (i.e. consumer surplus) from a reduction in import time delays.



Assume:

- Perfectly elastic supply of imported goods, i.e. that the country is a small economy relative to world supply so that infinite quantities can be imported at a given price.
- Constant unitary elasticity of demand for imported goods, i.e. that a 1 percent decrease in price leads to a 1 percent increase in the quantity demanded. Since the demand for imported goods is an aggregate demand over a wide variety of goods, constant unitary elasticity can be thought of as an “average” over elastic and inelastic demands.
- Importers charge a fixed percentage mark-up  $m$  over the import price when selling imported goods to consumers, and the costs from time delays are a part of this fixed percentage mark-up.

Thus, the volume of imports at the border,  $M$ , is  $P*Q$ , where  $P$  is the import price and  $Q$  is the quantity. The price to consumers, including the costs of trade delays is  $(1+m/100)*P$ . The percentage tariff equivalent of one day of trade delay for imports is  $t_m$ .

(Note the values for  $t$  in the attached tables are presented in percentage points;  $t = 0.6$  means the tariff equivalent cost of one day of delay is 0.6 percent [and not 60 percent] of the price. The \$ value of that tariff would be calculated by  $t/100*P$  or  $0.006 * P$ .)

A one-day reduction in trade delays will reduce the price to consumers from  $(1+m/100)*P$  to  $(1+(m- t_m)/100)*P$ , or by  $t_m$  percent, and increase the quantity demanded by  $t_m$  percent.

1. We can estimate the increase in the volume of imports as follows:

Although the quantity demanded by consumers, and thus importers, increases by  $t_m$  percent, the price paid by importers at the border does not change, thus the increase in the volume of imports equals the new volume of imports minus the old volume of imports or:

$$\begin{aligned} &= P*(1+ t_m/100)*Q - P*Q \\ &= P*Q + t_m/100*P*Q - P*Q \\ &= t_m/100*P*Q \\ &= t_m/100*M \end{aligned}$$

2. We can estimate the increase in welfare (or consumer surplus) as follows:

Since the supply curve is horizontal, the increase in consumer surplus is the rectangle formed by the decrease in consumer price at the original quantity of imports plus the area of the triangle under the demand curve to the right of the original quantity of imports and to the left of the new quantity of imports.

Where the value of imports at the border is denoted by  $M = P*Q$  and the tariff-equivalent of one day of delay for imports is  $t_m$ , the area of the rectangle:

$$\begin{aligned}
 &= (1+m/100)*P*Q - (1+(m- t_m)/100)*P*Q \\
 &= P*Q + m/100*P*Q - P*Q - m/100*P*Q + t_m/100*P*Q \\
 &= t_m/100*P*Q \\
 &= t_m/100*M
 \end{aligned}$$

Constant unitary elasticity of demand means that that a  $t_m$  percent reduction in price will lead to a  $t_m$  percent increase in the quantity demanded. So, the area of the triangle is one half the area of the rectangle formed by the decrease in the price paid by consumers and the increase in the quantity demanded. That is, the area of the triangle is:

$$\begin{aligned}
 &= 0.5*[(1+m/100)*P - (1+(m- t_m)/100)*P]*[(1+ t_m/100)*Q - Q] \\
 &= 0.5*( t_m/100*P)*( t_m/100*Q) \\
 &= 0.5* (t_m/100)^2*P*Q \\
 &= 0.5* (t_m/100)^2*M
 \end{aligned}$$

Thus, the gain in welfare is:

$$\begin{aligned}
 &= t_m/100*M + 0.5* (t_m/100)^2*M \\
 &= (t_m + 0.5* (t_m/100)^2)*M
 \end{aligned}$$

For example, if  $t_m = .008$  (or 0.8 percent), then the gain in consumer surplus from a one day decrease in import delays is  $0.008032*M$ , or 0.8032 percent of the original value of imports.

In the case of Antigua and Barbuda, the estimated range for  $t_m$  is 0.6 percent to 0.9 percent. Thus a one day decrease in import delays should increase consumer surplus by  $0.006018*M$  to  $0.0090405*M$ .

These values give us a range of lower bounds on the gain if we believe that the time cost of import delays includes (or is correlated with) additional costs to those from time in shipment.

These formulae are for a one day decrease in delays. If the number of days decrease in import delays is denoted  $n_m$ , then the increase in volume of imports for an  $n_m$  day decrease is:

$$= t_m/100* n_m *M$$

And the gain in welfare is:

$$=( t_m/100* n_m + 0.5 * (t_m/100* n_m)^2)*M$$

## Exports

When it comes to exports, even simple assumptions do not allow us to use simply geometry to estimate the gain in welfare, which in this case is the increase in producer surplus. However, we can estimate the increase in the volume of exports.

Assume:

- Perfectly elastic demand for exported goods, i.e. that the country is a small economy relative to world demand so that infinite quantities can be exported at the world price.
- Constant unitary elasticity of supply of exported goods, i.e. that a 1 percent decrease in cost leads to a 1 percent increase in the quantity supplied. Since the supply of exported goods is an aggregate supply over a wide variety of goods, constant unitary elasticity can be thought of as an “average” over elastic and inelastic supplies.
- Time delays for exporting affect exporters like production costs.

Thus, the volume of imports at the border,  $X$ , is  $P*Q$ , where  $P$  is the world price and  $Q$  is the quantity. The tariff equivalent of one day of trade delay is  $t_x$ , which is a percentage.

(Note the values for  $t$  in the attached tables are presented in percentage points;  $t = 0.6$  means the tariff equivalent cost of one day of delay is 0.6 percent [and not 60 percent] of the price. The \$ value of that tariff would be calculated by  $t/100*P$  or  $0.006 * P$ .)

A one day reduction in time delays to export will reduce costs to exporters by  $t_x$  percent and thus increase the quantity supplied by  $t_x$  percent.

We can estimate the increase in the value of exports as:

$$\begin{aligned} &= P*(1 + t_x/100)*Q - P*Q \\ &= (1 + t_x/100 - 1)*P*Q \\ &= t_x/100*P*Q \\ &= t_x/100*X \end{aligned}$$

This value is a lower bound if we believe that the time cost of export delays includes (or is correlated with) additional costs to those from time in shipment.

Looking at the calculated regional values of  $t_x$  for exports in the attached table, we see that they range from 0.4 to 1.0 percent. If we take these as lower bounds, they are actually quite consistent with the Djankov, Freund, and Pham estimates that a one day reduction in export delays should increase exports by 1.0 percent.

This formula is for a one day decrease in delays. If the number of days decrease in export delays is denoted  $n_x$ , then the increase in volume of exports for an  $n_x$  day decrease is:

$$= t_x/100*n_x*X$$

## **Volume of trade**

Based on the assumptions and calculations above, the increase in the volume of trade from decreases in time delays to imports of  $n_m$  days and to exports of  $n_x$  days is

$$= t_m/100 * n_m * M + t_x/100 * n_x * X$$

## **Discussing the estimates**

For a given country, there may be information on whether the assumptions of supply and demand price elasticities are good approximations. This information can be used to discuss the “biases” in the estimates. For example, if the majority of imports are basic foods, then demand may be inelastic — that is, the quantity demanded is not highly responsive to changes in prices. In that case, the increase in imports and the increase in welfare from a decrease in trade time will be smaller than the estimates from the above equations. Another example could be one where supply is elastic — that is, the quantity that firms are willing to supply to the world market is very responsive to changes in prices. In that case, the increase in exports from a decrease in trade time will be greater than the estimate from the above equation. Similarly, one could examine possible biases from the supply of imports and the demand for exports, e.g. information about the given country’s relationship to the world market.