

# Iceberg ‘melt’ of African trade costs: Evidence and determinants of customs reform

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## Abstract

This paper focuses on why customs-related transport costs change, particularly in developing countries, and whether this is through targeted technical assistance projects or through other exogenous factors. We then compare these findings to trade infrastructure changes—for ports and roads—to draw empirical conclusions about the prospects for attaining customs improvements. Furthermore, a deeper dive into the summary statistics reveals that many of the countries with the fastest improvements in trade infrastructure and institutions are in Africa. This finding motivates a large-N time series model to determine why customs service levels vary across time and space. Ultimately, we concur with data and theory that warn that such institutional changes, while valuable, are difficult to achieve.

## 1. Introduction

*The Economist* (2002) famously applied Paul Samuelson’s depiction of bilateral trade costs as melting icebergs to an African context through the plight of a beer truck making its four-day delivery over just 500 kilometres. The attenuated Cameroonian journey described in *The Economist* was beset by a mix of poor infrastructure and corrupt government officials, and by the end of the journey only two-thirds of the cargo remained. To better address occurrences like this, customs reforms are often an integral part of development projects designed to improve trade flows through infrastructure projects—for example, The World Bank conducted 117 customs modernisation activities between 1982 and 2002 (deWulf & Soko, 2005, p. 129). However, the data and theory warn that such institutional changes, while valuable, are also difficult to achieve.

For context, the paper delves into determinants of customs reforms using trade-related infrastructure as a comparison. We focus on developing countries where conditions are poor, and demonstrate which regions have seen the most variation. We then compare these findings to trade infrastructure changes for ports and roads to draw empirical conclusions about the prospects for attaining customs improvements. A closer look into the summary statistics reveals that many of the countries that have shown the most rapid improvements in customs infrastructure and institutions are in Africa. In sum, we find that customs is frequently ‘institutionalised’ around a mean result that shows very little change over time, but a few countries in sub-Saharan Africa (SSA) are positive outliers, so institutional stagnation is not a foregone conclusion.

This last finding motivates a broader statistical analysis for determinants of customs service levels. A large-N time series attempts to determine why customs service levels vary across time and space and finds a complex response: while technical assistance appears to have no significant effect on customs performance, the political environment does. Stronger democracies have a small correlation with customs and this also applies to more stable countries. In summary, the data do not reveal a magical ‘insulation’ to thwart customs-related melt, the magnitude of the significant coefficients are small—fitting with the institutional change literature that generally predicts customs reform to be slow and

incremental. The paper sets out to show that there are fewer changes in African customs reform than there are improvements in ports and roads, but points to a few outliers, such as Rwanda and Kenya, that may offer interesting lessons.

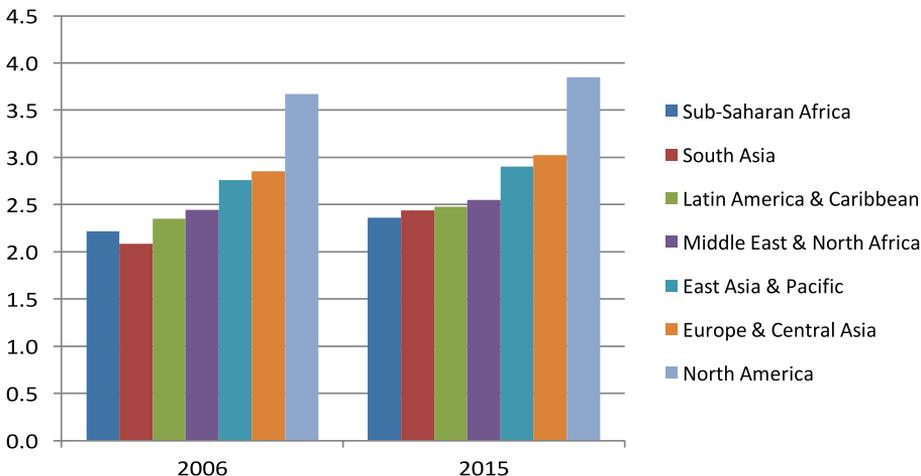
## 2. Data and hypotheses

In order to illustrate regional comparisons in trade facilitation performance over time, as well as isolating potential determinants of customs performance, this paper draws on a range of data, as outlined below.

### Dependent variables

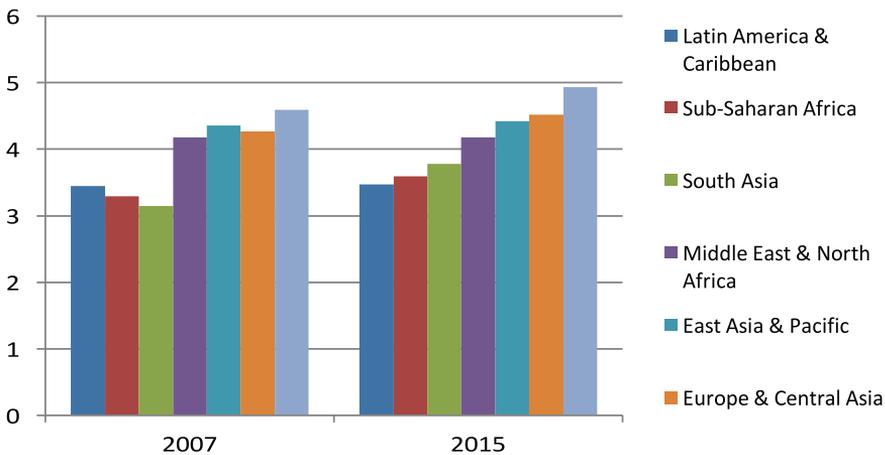
A series of papers associate customs reforms with higher trade flows. For example, Wilson, Mann and Otsuki (2003) make this claim, noting that customs reforms are important, if to a lesser extent than infrastructure improvements. Korinek and Sourdin (2011) elaborate on this finding to show that more efficient customs procedures can have a greater trade impact than distance or transport costs, and Velea, Cado and Wilson (2010) contend that privatising customs inspection processes facilitates imports by 2 to 10 per cent as these firms introduce better practices that accelerate cargo-processing and improve reliability. In addition, Martí, Puertas and García (2014) use gravity models to show that improving customs performance (as measured by World Bank's logistics performance index (LPI) data), would result in higher volumes of trade in SSA. Therefore, we have used the same customs variables from LPI, which range from 1 (lowest) to 5 (highest), to proxy the country's customs-clearance process in order to compare how developing regions fare, and to highlight why some countries perform poorly. For example, Figure 1 shows the average customs score, by region, in 2006 and in 2015. Note that over that time, SSA was overtaken by South Asia, dropping by one position to last place, and while both regions improved, South Asia had a greater level of improvement.

Figure 1: Regional average for LPIs customs data, 2006 and 2015



As a robustness check, we also ran the models with *Burden of customs procedure* as the dependent variable. This is similar to customs and measures business executives' perceptions of their country's efficiency of customs procedures. The variable ranges from 1 (lowest) to 7 (highest) and is compiled by the World Economic Forum for its annual Global Competitiveness Report. Similar to customs ratings (Figure 1), South Asia overtook SSA over the last decade but SSA also overtook Latin America and the Caribbean in the latter dataset (Figure 2).

Figure 2: Regional average for WEFs burden of customs data, 2007 and 2015



With respect to changes over time for these customs measures, the theoretical literature anticipates that this will be challenging. For instance, Mahoney and Thelen (2010, p. 1) describe institutional change as ‘slow and piecemeal’, while Greif and Laitin (2004) explain, from a game theory approach, that no actor has an incentive to deviate from their persistent behaviour. In other words, poor customs performance may be the result of a Nash equilibrium outcome so that no stakeholder has an incentive to reform the status quo. To do so would leave them worse off. Although it is difficult to compare percentage changes between customs and infrastructure data, we can tentatively test this theory by comparing changes in SSA with changes in other regions. It is in that context that we then look for incremental determinants of institutional change across customs regimes.

## Independent variables

### Donor effectiveness

Historically, governments have tried various means to remedy bureaucratic corruption, including improving government salaries (Becker & Sigler, 1974; Besley & McLaren, 1993; Mookherjee & Png, 1992; Polinsky & Shavell, 2001), and outsourcing work to private firms to operate customs. For example, the Ghanaian Parliament passed a bill to double police salaries in an effort to limit petty corruption within the force, but this had the opposite effect—officers responded by significantly increasing the bribes they collected from truck drivers (Foltz & Opoku-Agyemang, 2015). On the latter, research has found a positive impact on tariff collection, at 2.6 times the cost of the reform program. To test these impacts more broadly, we use technical cooperation as a percentage of GDP from the OECD statistics, which measures donor-funded projects aimed at improving skills and services in recipient countries. These projects, valued at more than \$17 billion across all countries in 2014, accounted for 19 per cent of grant aid for that year. The data are not restricted to trade-related projects but customs reform is a key avenue to economic growth, so the data provide a general proxy for institutional reform programs to set up the first hypothesis that *current institutional reform projects (technical assistance) improve customs performance*.

### Democracy

Kunicova (2006) argues that democracy is often thought to limit political corruption and Chang and Golden (2010) agree with this argument. The model accounts for this with a Polity variable from the Polity IV Project, which ranges from 10 (strongly democratic) to –10 (strongly autocratic),<sup>2</sup> which sets up the second hypothesis that *higher levels of democracy equate to improved customs performance*.

### State capacity

In weak states, bureaucrats do not perform effectively (Oeschlin, 2010, p. 631), either when it comes to providing infrastructure investments or to conducting law enforcement (Buhaug & Rod, 2006; Berman, n.d., p. 1). Specifically, customs agencies of weaker states are frequently associated with revenue fraud and shipment delays (Yang, 2008). In turn, stronger states should have better institutions so we use levels of income taxes as ‘exact indicators of government presence’ (Organski & Kugler, 1980, p. 74). To explain why, as Levi (1988, p. 1) describes, ‘[t]he history of state revenue production is the history of the evolution of the state’. Thies (2009) continues that studying taxation provides leverage on the bureaucratisation process as well as the state’s extractive capacity.

In addition to taxation, Fearon and Laitin (2003) and Collier & Hoeffler (1998) use income as a proxy for state capacity. Arbetman-Rabinowitz & Johnson (2007) explain that governments are constrained by their limited wealth when it comes to pursuing policy objectives. Even if they hold extractive power, there is only so much governments can do with a small economic base and an even smaller pool of economic resources. Consequently, we use *lag of tax per GDP*, which refers to ‘compulsory transfers to the central government for public purposes’ as well as *log of GDP*, both variables come from the WDI, to test the third hypothesis that *stronger states have better customs performance*.

### Commercialism

Spruyt (1994, p. 217) notes that traders seek property rights from state-level rulers who enjoy the economies of scale to achieve this. At a bureaucrat level of analysis, Streatfeild (unpub.) draws on this commercialist theory to test how trade in goods shapes Ghana’s customs officers’ bribe collection rates. Consequently, we measure this with WDI data on merchandise trade as a share of GDP, for the fourth hypothesis that *increases in international trade volumes improve customs performance*.

### Lag political stability

Bates’ (2008) theory explains that when leaders’ government decision-making is based on their low valuation of future returns in times of instability, leaders are less inclined to invest in the longer term. Oeschlin (2010) adds that political instability shortens the time horizon for the incumbent regime so that they are less inclined to finance growth-promoting institutions that would only politically benefit future regimes. For this, World Governance Indicators’ (WGI) *Political Stability and Absence of Violence/Terrorism* variable measures perceptions of the likelihood of political instability and/or politically-motivated violence, for the fifth hypothesis that *higher levels of stability result in improved customs performance*.

### Rentierism

Reliance on revenue from natural resources may result in weak states (Mahdavy, 1970). Ross (1999) explains that higher income levels can improve democracy levels but this relationship can be mitigated by levels of oil wealth in the country. Arezki and Brückner (2009) confirm these findings, using fixed effects, to show that oil has a significant impact on corruption. We use the WDI *Natural Resource Rents per GDP* variable, which is the sum of oil, natural gas, coal (hard and soft), minerals and forest rents, as a share of GDP, to control for these effects in our analysis.

### Tariff reliance

Mishra, Subramanian and Topalova (2008) find that tariff variations have a positive elasticity with evasion, and higher tariff revenue can afford customs officers an opportunity to negotiate a bribe as the alternative official tax is costly. To measure for this, we use the WDI *Taxes on International Trade, as % of GDP* variable, as an indication of a state’s reliance on trade revenue in a given year.

### Infrastructural change

Infrastructural change could have a similar effect to trade tax revenue. Shleifer and Vishny (1993) theorise that improved infrastructure lowers the buyer's trade costs, which can then provide a greater opportunity to collect customs bribes. This is measured by the LPI infrastructure variable. In other words, as infrastructure improves, this may offer a negotiating opportunity to extract more bribes.

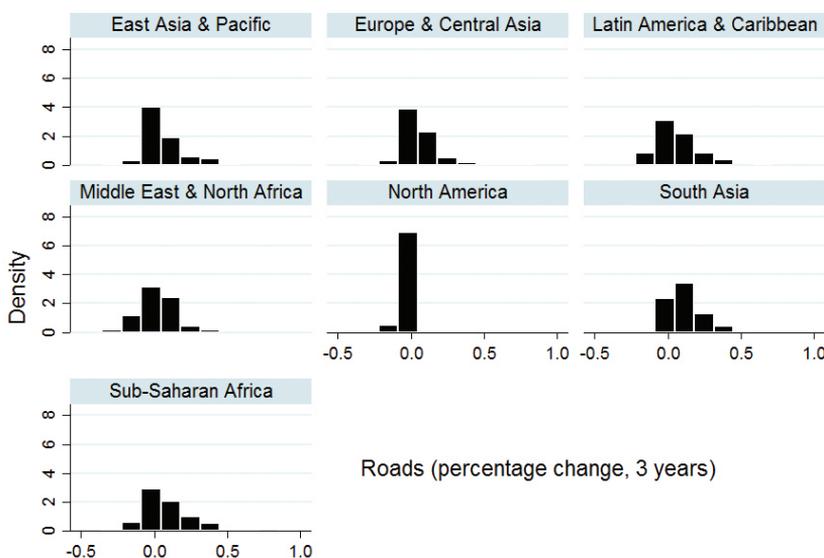
### Investment in infrastructure

We include the WDI *Log of gross fixed capital formation* measure of government commitment to invest in trade related infrastructure. It offers an indication of whether state budgets prioritise building infrastructure or the institutional reforms that accompany them.

## 3. Descriptive statistics

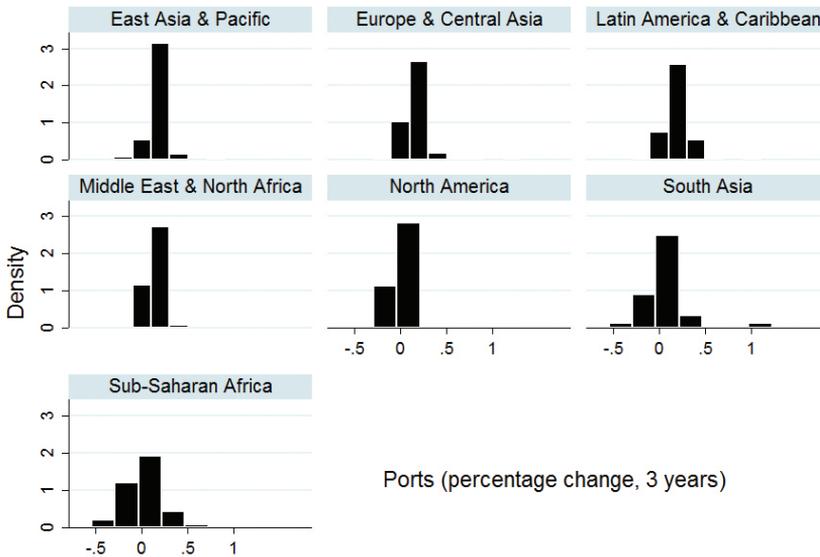
The LPI and WEF customs data help to illustrate the relative speed of reform with respect to trade infrastructure or institutions. Figures 3 and 4 show this through the distribution of road and port quality changes over a three-year period. In other words, each observation in the histograms below reflects the percentage change of an individual country-year, between 2007 and 2015, grouped by region. Notably, North American ports and roads have changed very little over time, with almost all observations clustered at or around the zero per cent change mark. This region also has the highest quality and most sustained infrastructure. South Asia's roads, by contrast, are more widely distributed than that with some county-observations approaching 50 per cent change for the previous three years. Further, SSA roads exhibit more of a normal distribution with a large number of its roads in decline, but also that region exhibits the only countries with more than 50 per cent growth as well. However, SSA ports have a flatter distribution than its roads and, like the histograms for other regions, these centre around zero per cent change, such that the median country had very little movement to its key trade infrastructure in any given region.

Figure 3: Three-year change to roads, by region



Source: Author's calculations from Logistics Performance Index, World Bank.

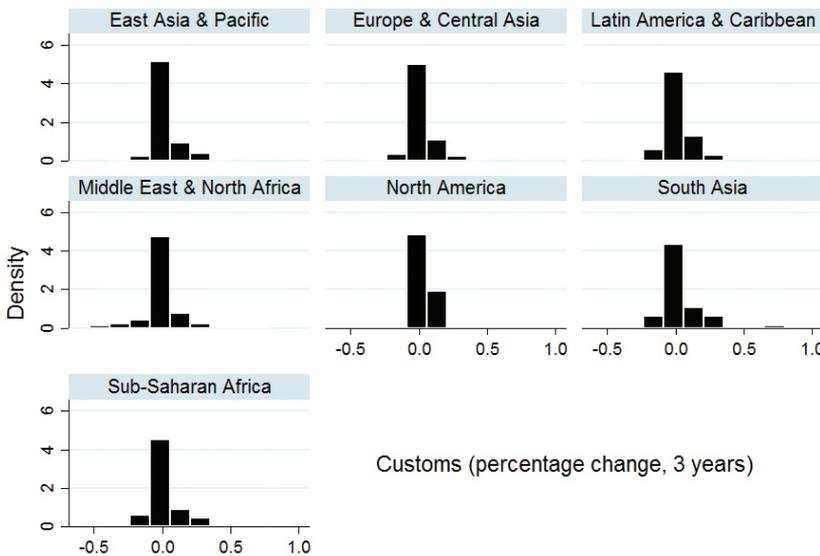
Figure 4: Three-year change to ports, by region



Source: Author’s calculations from Logistics Performance Index, World Bank.

As anticipated by theories of institutional change, customs reform is slower than infrastructure reform as the density is higher and around zero per cent across most regions. Although developed regions like North America see more stable roads and ports conditions, in SSA, 61 per cent of the country-observations (positively or negatively) changed by less than 5 per cent over a three-year timeframe. This is almost double the share for SSA’s roads (31 per cent) and ports (24 per cent). In other words, these data comport with the expectation that institutional change is more sluggish than infrastructure improvements in SSA, further motivating the interest in reaping the benefits from customs change.

Figure 5: Three-year change to customs, by region



Source: Author’s calculations from Logistics Performance Index, World Bank.

To that end, digging deeper into the data shows that there are several positive outliers in SSA countries, which are also some of the fastest reformers in both trade infrastructure and customs. Table 1 reflects three-year growth in country observation years. Kenya in 2010 had the ninth-fastest three-year growth rate for infrastructure improvements. In the following year Kenya also reflected a continuation of that infrastructure growth, as it ranked tenth. In sum, 16 of the 20 fastest improving country-years for infrastructure were in SSA. Likewise, 15 of the 20 fastest customs reformers were also on that continent. Although many SSA countries are slow to change their trade infrastructure or their customs regimes, there are several that are global leaders in this, providing helpful variation for the ensuing comparative analysis. Consequently, the paper next considers some broad-brush indicators for what determines customs performance, over time.

*Table 1: Three-year growth in infrastructure and customs (LPI Data)*

Rank	Infrastructure	Year	Customs	Year
1	Congo, Rep	2010	Rwanda	2010
2	Afghanistan	2009	Algeria	2009
3	Namibia	2010	Afghanistan	2009
4	Rwanda	2010	Kenya	2012
5	Congo, Rep	2009	Qatar	2010
6	Eritrea	2010	Namibia	2010
7	Djibouti	2011	Kenya	2012
8	Rwanda	2009	Niger	2009
9	Kenya	2010	Benin	2009
10	Kenya	2011	Botswana	2009
11	Niger	2009	Solomon Islands	2009
12	Egypt	2009	Kenya	2010
13	Malawi	2009	Rwanda	2009
14	Congo, Rep	2011	Djibouti	2011
15	Botswana	2009	Egypt	2009
16	Burkina Faso	2010	Estonia	2011
17	Tanzania	2010	Uganda	2009
18	Jamaica	2009	Comoros	2010
19	Rwanda	2011	Djibouti	2009
20	Algeria	2009	Eritrea	2010

*Source:* Author's calculations from Logistics Performance Index, World Bank.

## 4. Method and results

The dataset is a strongly balanced panel so we use either fixed or random effects models to test the above hypotheses. With respect to model 1 of Table 2, the Hausman test is significant when customs is the dependent variable and the Africa dummy variable is not included, so that model uses fixed effects. In addition, to adjust for the modified Wald test, which is significant when using customs as the dependent variable, the model exhibits heteroskedasticity so we use robust standard errors, but these are not clustered as the timeframe is only seven years. The remaining models in Table 2 employ random effects models, either because they include time-invariant dummies (models 2 and 4) or because, in the case of model 3, the probability of F-statistic is above 0.05 for the fixed effects version. As far as the model with the best fit, the second regression has the highest  $R^2$  and also has more observations included than the two Burden of Customs models.

Technical assistance does not have any significant effect in any of the models in Table 2. This suggests that it does not improve customs performance, despite the large amount of money spent by donors for that purpose. As a disclaimer, this variable captures more than just trade-related institutional reforms, although customs should be a large focus in many countries, given trade's importance as a driver of economic growth. This leads us to consider not accepting the first hypothesis, with that important caveat.

In the first two models, democracy has a strongly significant but almost negligible impact on customs performance, while in the second two models polity has no statistical significance, which leads us to reject the second hypothesis; democracy does not affect customs performance to any great extent.

State capacity has a more complex relationship with customs in these models. The traditional measure, taxation, has no statistical significance in any of the models, but log of GDP is significant and positive in the two models with customs as the dependent variable. That latter finding fits with the expectation that larger countries have better institutions, but the magnitude decreases to one-third when controlling for Africa. Consequently, we see this also as a nuanced relationship and one that requires deeper study in developing countries, such as in Africa. For the purpose of this large-N analysis, however, we only cautiously do not reject the third hypothesis that stronger state capacity results in better customs performance.

The commercialist hypothesis holds up weakly, as well. In the first two models, if merchandise trade increases by a full standard deviation then it would correspond to improved customs scores of a little more than one-tenth of a point. This lends some support for the fourth hypothesis that trade increases correspond to improved customs performance.

Political stability is significant in each of the models but with differing signs. This is, in part, due to the effect of African countries, at least for model 2, where the impact is positive overall, but with a negative interaction effect for Africa. Models 3 and 4 also show a positive and statistically significant relationship. In sum, it appears that political stability increases customs performance, although this is not clearly the case for Africa.

Finally, efforts to improve trade-related infrastructure appear to have statistically significant but minor impacts on customs performance, and the direction is inconclusive. The data show that a ten-percentage point improvement in the former (one standard deviation) relates to just a 0.047 increase in customs performance, suggesting that efforts to improve customs performance by investing in large roads or ports projects do not directly influence institutional reforms in the short term.

Table 2: Fixed and Random Effects Results: Determinants of Customs Performance

Variable	Customs: FE	Customs: RE	Burden of Customs: RE	Burden of Customs: RE
Lag (Technical Assistance per GDP)	17.356	2.376	6.627	6.925
Polity	0.003***	0.003**	0.002	0.002
Log (GDP)	0.746**	0.249***	0.057	0.061
Lag (Tax per GDP)	-1.114	-0.455	-0.370	-0.378
Lag (merchandise trade)	0.003**	0.004***	-0.001	-0.001
Lag (Political Stability)	-0.118**	0.090**	0.196***	0.211***
Lag (Natural Resource Rents per GDP)	-0.006	-0.012***	-0.006	-0.006
Infrastructure change	0.471***	0.459***	-0.343**	-0.338**
Log (GFCF)	-0.133	-0.044	0.022	0.023
International Trade Tax per GDP	-0.001	-0.009***	-0.014*	-0.014*
Africa		0.217**		0.062
Lag (Political Stability) * Africa		-0.176**		-0.120
Constant	-12.925*	-2.511***	2.410*	2.289*
N	410	410	376	376
n	86	86	76	76
T	7	7	7	7
p	0.001	0.000	0.000	0.000
R <sup>2</sup>	0.150	0.6393	0.337	0.344
Notes: * p < 0.1; ** p < 0.05; *** p < 0.01				

## 5. Conclusions

Examples like the depleted beer truck in Cameroon are bound to continue for much of Africa's short to medium term. Progress to improve customs performance that minimises such trade 'melt' does not come quickly or easily. This is reflected in the regression models above in which few of the independent variables have a sizable impact on customs outcomes. For example, directly targeting agencies for institutional reform may not even have any impact on their performance while improving structural conditions, such as stability, are less direct and may not even improve conditions in the lowest performing areas, such as in SSA. This fits with the institutional reform literature.

Andrews (2013, p. 14) summarises that today's institutional reform investments by international donors are either ineffective or are difficult to implement in the developing world. As a result, developing countries are not measurably improving the 'rules of their public sector and trading games'. Specifically, the African Development Bank (2012, p. 19) comments that government effectiveness scores in Sub-Saharan Africa have actually fallen between 1998 and 2006, and this is despite the fact that the World Bank has incorporated institutional reform into 70 per cent of its projects (Andrews, 2013, p. 11). However, the data also reveal examples of strong performers in SSA, such as Rwanda and Kenya. Although, large-N analysis may not suitably reveal their path to success, a qualitative analysis could provide important lessons for the region.

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## Notes

- 1 Jeremy Streatfeild is an International Trade Analyst at the United States International Trade Commission (USITC) and is grateful to Martha Lawless and Joann Peterson for extremely helpful comments and feedback. However, the views and opinions expressed in this article are those of the author and do not necessarily reflect the official policy or position of USITC or the individual Commissioners. All errors are my own.
- 2 The POLITY variable provides a convenient avenue for examining general regime effects in analyses but researchers should note that the middle of the implied POLITY ‘spectrum’ masks various combinations of DEMOC and AUTOC scores with the same POLITY score.

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Jeremy Streatfeild is an international trade analyst at the US International Trade Commission where he focuses on logistics and transportation in Africa. Prior to this, he was a country economist for six years at the Millennium Challenge Corporation, working on the sustainability of trade infrastructure in Africa, evaluating ports, maintaining roads, and reforming Customs across the continent. He has also worked on developing hydropower investments in Nepal. Jeremy holds a PhD in political science from the George Washington University and a Bachelor of Arts from Bowdoin College, Maine.