

## Unreliable Logistics Services, Productivity and Trade Patterns

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***How does unreliability affect firms and industries? Exploring the impact of supply chain risk in Sub-Saharan Africa, this project shows how business actors confronted with unreliable supply chains specialize into producing less complex goods, as their production is less sensitive to disruptions***

### Background

A common feature of business environments in Sub-Saharan Africa is high levels of risk and uncertainty. Inputs are delayed in port, land rights are unclear, import permits are delayed, and foreign currency might not be available. This unreliability can harm firm productivity in many ways. Missing inputs disrupt production and late deliveries to customers damage a firm's reputation. Mitigating this unreliability by holding greater inventories or by having to making informal payments can be particularly costly.

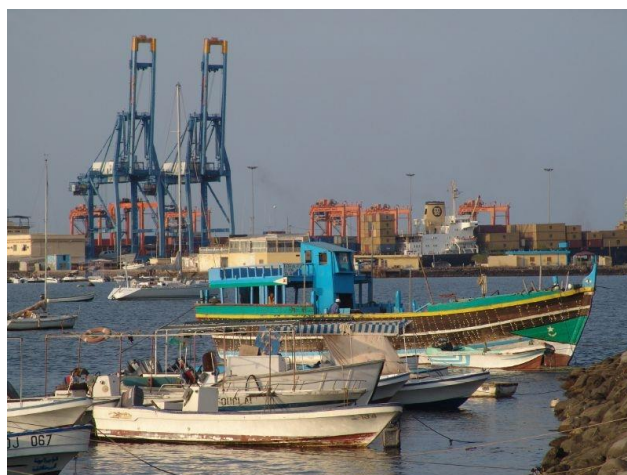
Moreover, the costs and negative effects of an unreliable business environment vary across firms or sectors. Unreliability has a particularly large effect when a production process has many independent sources of error, when the output is sensitive to delays, and when it is costly to keep an inventory of inputs. To a first approximation, it seems that the production complex goods – the ones that are produced using a range of specific inputs – should be more sensitive to unreliability.

This project explores the consequences of the unreliability of the Sub-Saharan African business environment, focusing on unreliability stemming from poorly functioning logistics systems. It shows that unreliability can help us understand two facts about Sub-Saharan African economies: first, the overall low productivity and second, a specialization in the production of less complex goods, which are comparatively cheaper to produce given a more uncertain environment.

### Methodology

We study this question in two complementary ways: one case-study of logistics uncertainty in Ethiopian manufacturing, and one study which uses international trade data to analyze the effect of an unreliable economic environment on comparative advantage.

For the case study, we perform 20 semi-structured interviews in Ethiopia with practitioners in logistics, manufacturing, and the government, to test whether unreliability is a relevant issue for local actors. We also test if our proposed mechanisms coincide with those that actors find important.



**Figure 1: Port Doraleh, Djibouti. Ethiopia channels most of its exports through ports in Djibouti**

## **Private Enterprise Development in Low-Income Countries**

We also perform a back-of-the-envelope calculation of the cost of unreliable supply chains for the Ethiopian textile industry. We start with reasonable estimates of delay risks and costs of holding inventories to calculate to what extent supply chain unreliability can explain the wage differential between Ethiopia and Bangladesh.

In the trade study, we first construct an economic model to understand how variations in supply chain unreliability between countries shape trade patterns. The hypothesis is that some industries are less sensitive to unreliability than others, and that countries with unreliable supply chains will specialize in industries with low sensitivity to disruptions. In particular, the *number of customized inputs* is a key indicator for the sensitivity to unreliability. The intuition is that if a firm uses a lot of customized inputs, the production process has a large number of error sources. Thus, as the harm caused by unreliability grows when there is a large number of error sources, unreliable countries should specialize in industries with few error sources.

We test this hypothesis by using:

1. Data on how much countries export from different industries
2. Data on how many customized inputs each industry uses.
3. Country data on the quality of logistics systems and on government effectiveness.

With this data, we test whether countries with high quality logistics systems and an effective government export goods with more customized inputs.

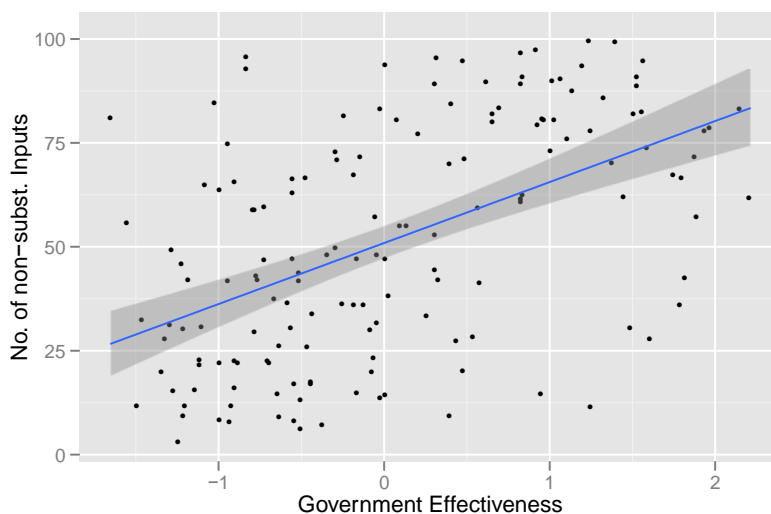
### Research findings

The interviews confirm that firms in Ethiopia see supply chain unreliability as an important constraint. Further, they lend support to the hypothesized mechanisms: risk of production disruption, risk of reputation loss, and a high cost of holding safety-stock inventory.

However, the interviews also suggest some complications in our initial hypothesis. Importantly, different Ethiopian firms are not faced with the same logistics problem. Instead, firms have different access to good logistics services depending on sector, connections, and their experience in handling the system. The results suggest that unreliability might not primarily be bad because it is a uniform penalty to productivity, but because it leads to misallocation between firms and to high entry barriers.

Our back-of-the-envelope calculation suggests that logistics unreliability can explain 25% of the wage differences between Ethiopia and Bangladesh for fast fashion, but only 7% for slow fashion such as basic t-shirts. The difference between slow and fast fashion is the cost of holding an inventory to mitigate supply shocks.

In the trade study, we confirm that countries with reliable supply chains export more complex goods. The estimates are large and economically meaningful, and the effect survives a range of robustness checks.



**Figure 2: Positive relationship between government effectiveness and average number of customized (“complex”) inputs in exports**



## Private Enterprise Development in Low-Income Countries

### Potential policy impact

Our project suggests that the reliability of the business environment might be an important issue for policy makers.

Furthermore, given the importance of unreliability, it could be worthwhile to modify the way in which business climate is measured in surveys such as the *Doing Business Project* and the *World Enterprise Surveys*. The *Doing Business* project focuses mainly on de jure times taken to perform different tasks, and does not provide information on dispersion. The *World Enterprise Surveys* does ask about de facto times taken, which means that one can measure variations between firms in how long different services take. However, given that some firms have better service levels due to government contacts and more experience, it is not clear that variations between firms only reflect the unreliability faced by an individual firm. Our project suggests that it would be worthwhile to complement current survey designs with questions explicitly aimed to capture the unreliability in policy implementation faced by firms.

### Moving Forward...

Looking ahead, we hope to develop the project both theoretically and empirically. For theory, our model currently predicts that unreliability is particularly costly when a production process has many error sources. We want to extend these predictions to the case when firms can mitigate unreliability by for example holding inventories, giving bribes and choose less complex technologies.

On the empirical side, we hope to improve our measures of industry complexity, our measures of the degree of reliability in the economic environment, as well as have a more credible estimation of trade effects, for example by using a panel instead of a cross-section of trade data. We are also planning a mini-survey in Uganda and Sweden to test whether firms in an unreliable environment choose a less complex production technology to mitigate uncertainty.