How should Uganda grow?
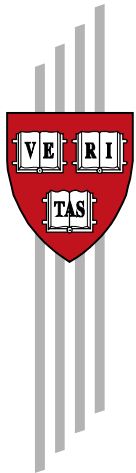
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Working Papers

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CONTENTS

ABSTRACT

Income per capita in Uganda has doubled in the last 20 years. This remarkable performance has been buoyed by significant aid flows and large external imbalances. Economic growth has been concentrated in non-tradable activities leading to growing external imbalances and a growing gap between rural and urban incomes. Future growth will depend on achieving sufficient export dynamism. In addition, growth faces a number of other challenges: low urbanization rate, rapid rural population growth and high dependency ratios. However, both the dependency ratio and fertility rates have begun to decline recently. Rural areas are also severely overcrowded with low-productivity subsistence agriculture as a pervasive form of production. Commercial agriculture has great possibilities to increase output, but as the sector improves its access to capital, inputs and technology it will shed jobs rather than create them.

These challenges combined tell us that future growth in Uganda will require a rapid rate of export growth and economic diversification. The country faces the prospect of an oil boom of uncertain size and timing. It could represent an important stepping stone to achieve external sustainability, expanded income and infrastructure and a greater internal market. However, as with all oil booms, the challenges include avoiding the Dutch disease, managing the inevitable volatility in oil incomes and avoiding inefficient specialization in oil. Policies that set targets for the non-oil deficit could help manage some of these effects, but a conscious strategy to diversify would still be needed.

The best strategy is therefore to use the additional oil revenue and accompanying investments to promote a diversification strategy that is sustainable. To determine how to encourage such a transformation, we draw on a new line of research that demonstrates how development seldom implies producing more of the same. Instead, as countries grow, they tend to move into new industries, while they also increase productivity in existing sectors. In this report, we analyze what those new industries might be for Uganda.

To do so, we first look to those products which balance the desire to increase the diversification and complexity of production, while not over-stretching existing capabilities. These include mostly agricultural inputs, such as agrochemicals and food processing. In addition, Uganda should concurrently develop more complex industries, such as construction materials, that are reasonably within reach of current capabilities and will be in great demand in the context of an oil boom. Here, the fact that Uganda is landlocked and faces high import costs will provide natural protection to the expanding demand in Uganda and neighboring countries. We conclude with a discussion of the government policies that will support Uganda in developing new tradable industries.

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1. INTRODUCTION

Growth Story

Income per capita in Uganda has doubled in the last 20 years (Figure 1). Much of this growth was a rebound to past levels of economic activity and the resumption of trade following two decades of extreme political instability and an asset-destroying civil war. Some was due to large-scale donor-financed rehabilitation and some can be attributed to the increase in international coffee prices in the early 1990s.

Figure 1: GDP per capita
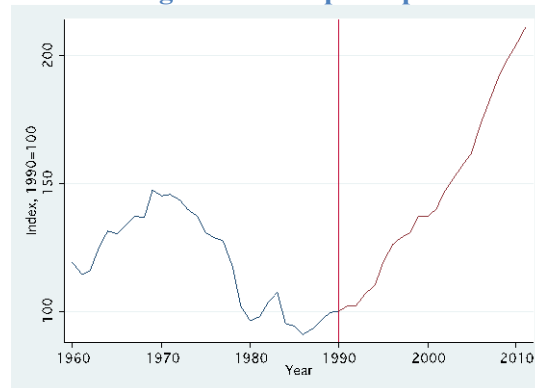
Source: WDI

During this period, Uganda also followed a comprehensive stabilization, rehabilitation and reform program. Rehabilitation allowed rural people to profitably work their land and open up new land for cultivation, and it allowed businesses to re-open their operations. Market liberalization allowed farmers and firms to make better choices on how much of what to produce, and with which inputs. Privatization removed inefficient state provision of products and services (World Bank, 2007).

These reforms accelerated, and then sustained, Uganda's growth. Indeed, most post-conflict rebounds typically run their course within six years (Collier and Hoeffler, 2001). Also, most growth episodes, however started, tend to expire within eight years or so, because they run-up against some new binding constraints (Hausmann et al, 2005). In contrast, Uganda's growth spurt is still running, for more than twice as long as would be regarded as average. More recently growth has decelerated owing to various internal and external factors like the recent global recession.

Growth Challenges

Despite Uganda's remarkable economic growth over the last few decades, continued growth will need to address challenges from the restructuring of economic activity.

High but declining dependency ratio - Uganda has one of the highest dependency ratios (ratio of non-working age population to working age population) in the world (Figure 2). The dependency ratio increased during the 1980's and 90's but has recently started to fall, a phenomenon known as the demographic bonus or window of opportunity. This should start to gradually relax the high dependency burden. As a consequence, there will be proportionally more people of working age as a part of the total population, allowing for more education of the young and more savings. A major policy challenge will be to hasten the demographic transition. It is estimated that currently the Ugandan economy needs to absorb about 392,000 new entrants into the labor market (Ministry of Gender, Labour and Social Development 2010). The labor force growth rate is estimated at 4.7 per annum in 2009/10 a rate which is even higher than the population growth rate. The growth in the youth labor force is even much higher estimated at 5.7 percent annually. The economy will

also need to generate many jobs for the rapidly expanding labor force, in order to exploit the potential benefits of the window of opportunity (Klasen, 2004).

Figure 2: World dependency ratios, 2011
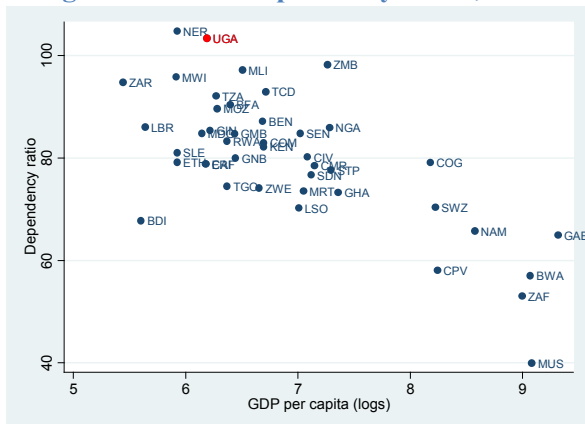
Figure 3: Uganda's dependency ratio

Source: WDI
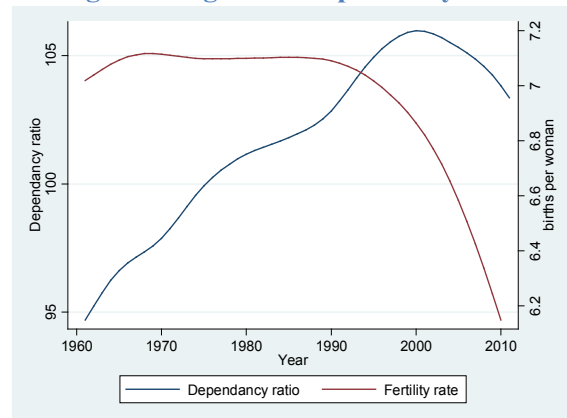
The main reason for Uganda's high dependency ratio is the high fertility rate. As shown by Figure 4, while other developing countries have undergone rapid fertility transitions, Uganda's fertility has remained stubbornly high, although it has started to decrease recently. One important fact for policymakers is that fertility is markedly lower in cities than in rural areas. Indeed, there is significant overcrowding in rural areas with over four people per hectare of arable land; this is double the density in the 1960s (Figure 5), in spite of a more than doubling of the amount of arable land. High population growth in rural areas has resulted in the persistence of subsistence farming and low agricultural productivity.

Figure 4: Fertility transitions
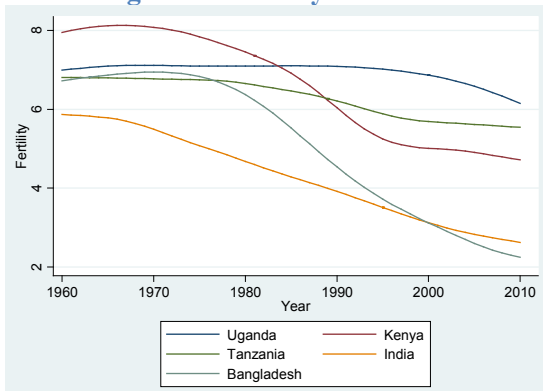
Figure 5: Rural population density

Source: WDI
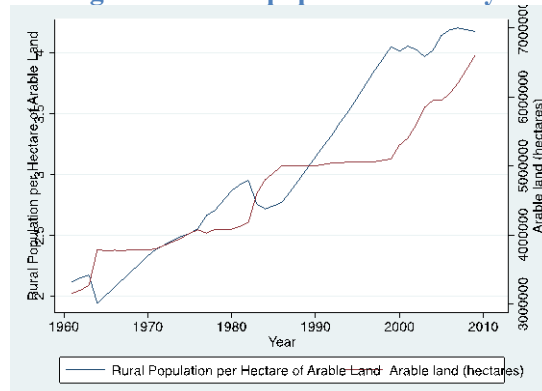
Low urbanization rates – Uganda also has one of the lowest urbanization rates in Africa (16%). Kampala accounts for one third of Uganda's urban population. Even though Ugandans are mobile, most people move from one rural area to another in search of fertile land. Others also move for security purposes; this is especially common from the Northern part of Uganda. More needs to be done to urbanize Ugandan cities by increasing their

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economic activities so as to attract more labor and related infrastructure and institutions.

Figure 6: Urbanization rate in Uganda
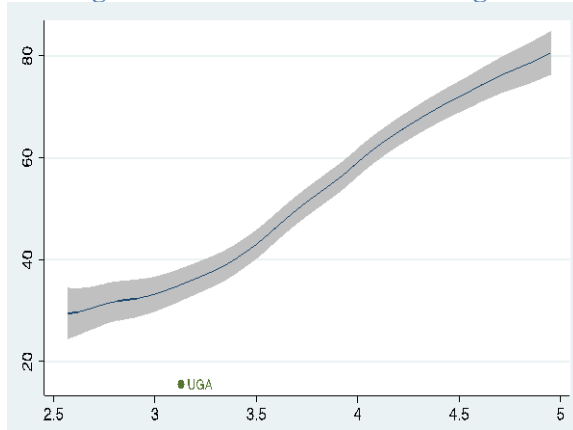
Figure 7: Tradable and Non-tradables

Source: WDI
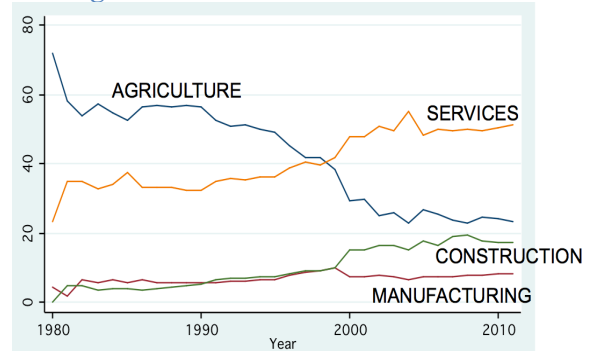
Low contribution of manufacturing and exports – Another challenge for Uganda is that recent growth has been concentrated in non-tradable activities (Fig 7). The industrial sector which includes mining, construction and manufacturing has seen a modest increase in its share of GDP from about 10 to 20 percent. Within this sector, construction has increased significantly from 4 percent in 1989 to about 12 percent in 2010. Growth of the manufacturing sector has been characterized by low capacity utilization which is estimated at 50 percent (Republic of Uganda 2010). The factors that contribute to low capacity utilization have been well articulated in the National Development Plan and these include credit rationing, limited skills and inadequate infrastructure. Hence growth has led to a large external imbalance with a current account deficit of -10.84% of GDP (Fig 8). This gap in foreign currency earnings has, to a large extent, been financed by aid inflows. Indeed, exports per capita are among the lowest in the world (Figure 9).

Figure 8: External balance
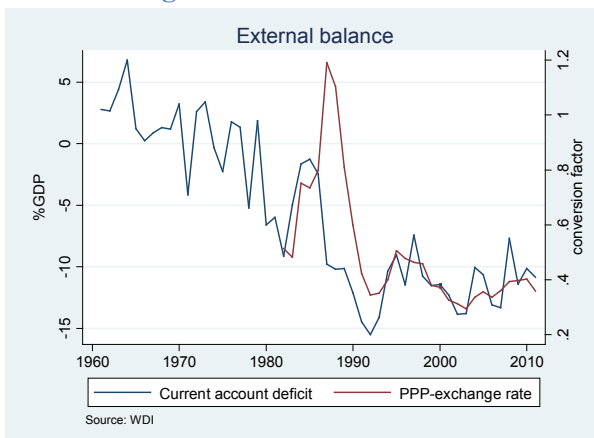
Figure 9: Exports per capita (2011)

Source: WDI

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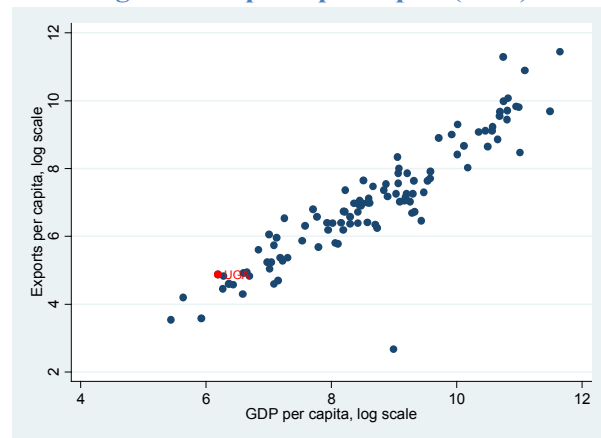
Uganda needs to increase its exports in order to create employment, reduce the current account deficit and sustain the growth it has enjoyed thus far. The good news is that exports per capita have been growing recently and are now greater than other sources of foreign exchange such as aid inflows and remittances (Figure 10). Recent export growth has been stimulated by demand in neighboring countries. South Sudan has emerged to be an important trading partner with Uganda demanding food and other manufactured material to help with reconstruction.

Figure 10: Exports and Aid
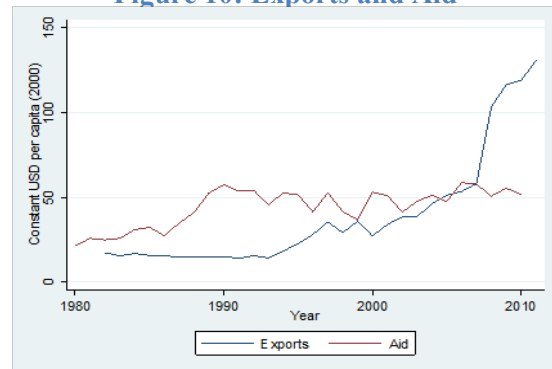
Source: WDI

Primary products dominate Uganda's exports - The lack of dynamism in manufacturing has resulted in Uganda's export basket being dominated by primary products (around 85%), including coffee, fish, tobacco, gold, and flowers (Figure 11). Reliance on these products has made the export sector vulnerable to fluctuations in world market prices and the vagaries of weather. Indeed, Uganda has faced a significant long-run decline in its terms of trade (Figure 12).

Figure 11: Uganda's Exports
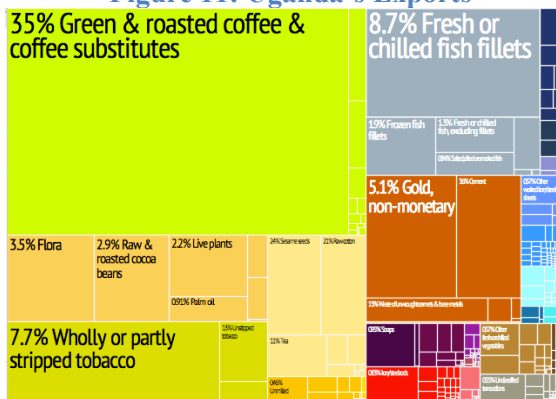
Source: Observatory of economic complexity

Figure 12: Terms of trade and GDP
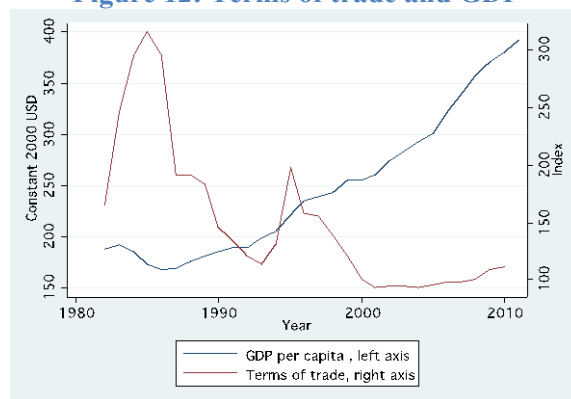
Source: WDI

The agricultural sector alone cannot address Uganda's demographic transition – Uganda exhibits one of the lowest agricultural productivity levels in the world. As shown in Figure 13, this can be partly attributed to Uganda's high agricultural employment per hectare of arable land. In subsistence agriculture, land plots are small and most tasks are performed by hand and with few inputs. This prevents economies of scale, particularly in the application of fertilizers or the use of machinery. Thus productivity per worker remains low.

There are technologies available to improve agricultural productivity in Uganda, and these should certainly be pursued. However, as can be shown in Figure 13, improving productivity per worker generally leads to less employment per hectare; and with a constant supply of arable land, this means less agricultural employment overall. The case of Korea is illustrative of the path followed by many countries as they develop.

Source: WDI

In the 1980's agricultural productivity in Korea was relatively low, and arable land was crowded with agricultural workers. As Korea increased the use of machinery and the application of fertilizers, agrochemicals and special seed varieties, productivity per worker increased. But this occurred as farmers realized they could produce similar or higher yields with less labor. As the rural population declines, plot sizes increased enabling the remaining farmers to work on more land per worker. In sum, the expansion of agricultural production and productivity in Korea, as in many other countries, released labor to the non-agricultural sector.

This is typical: as income per capita increases, the share of employment in agriculture declines. In fact, as Figure 14 shows, Uganda is above the 95% confidence interval in this relationship, indicating that it is unlikely that such a high ratio would be maintained as the country develops, making non-agricultural employment growth the most dynamic part of the labor market.

Overall, it is certainly true that there is great potential to improve output and productivity in agriculture in Uganda. However, this will lower the demand for labor, not raise it. Moreover, this will occur in an environment of rapid population growth, further emphasizing the need for non-agricultural employment. The challenge for Uganda is therefore to create productive jobs in other sectors to absorb the labor released from agriculture and that generated by population growth.
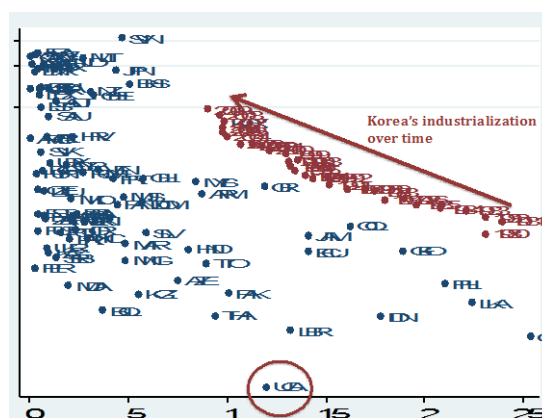
Figure 14: Percent of employment in agriculture vs. GDP per capita (in logs)

Source: WDI

Further, for farmers' incomes to increase as they produce more for the market, agricultural prices must decline by less than the increase in output. In other words, total food demand will need to increase. This increased demand for food will need to come from non-farmer households, from industrial use within Uganda, and from accessing new agricultural markets in the region and beyond. Therefore,

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it is important to develop new industries to increase demand for agricultural output.

Oil on the horizon – The discovery of oil in the Albertine basin has produced estimates of recoverable resources that have been increasing. In 2010, the estimate was of 800 million barrels in reserves. The current estimate is 3.5 billion barrels. In 2010, based on an average oil price of $75 per barrel, the World Bank estimated that oil revenues would constitute approximately 10-15% of GDP at peak production (World Bank, 2010) and that peak production would take place in 2020, with the government expected to earn $3.2 billion per year just from oil. By way of comparison, in 2008, total government revenue was $2.6 billion which implies that government revenue could more than double (Wiebelt, Pauw, Matovu, Benson, & Twimukye, 2011). Today the expectation is that reserves, prices and peak production are likely to be substantially higher than the World Bank 2010 estimate, but the process of setting up the production capacity and the pipelines will be slower than initially planned.

Summary of growth challenges and structure of the report – Uganda faces the challenge of increasing employment opportunities fast enough to absorb a rapidly growing workforce. The agricultural sector cannot drive employment growth and in fact is likely to shed labor as it develops. Growth in the oil sector will directly contribute relatively few jobs, but through increasing aggregate demand, the oil boom will generate new employment in Uganda's non-tradable sectors like construction, transportation, and wholesale/retail services.

While the oil boom will boost Uganda's non-tradable sector, it also has the potential to harm the tradable sector including agriculture. This could lead to inefficient specialization in oil and hinder the country's ability to diversify into new economic activities. Currently, Uganda's exports are concentrated in primary products like coffee, cotton, tea and fish that require far less complex technologies and labor skills than other products, leading to a low overall level of economic complexity. Countries seldom become rich by producing more of the same products. Rather, countries grow by moving into new products and into more complex products. This idea stands in contrast to the idea that countries should specialize in a few industries in which they have comparative advantage.

To examine avenues for further diversification in Uganda, section 2 provides background on the economic complexity literature and presents evidence of the importance of economic complexity and diversity in countries around the world. Section 3 uses this approach to evaluate the complexity and diversity of Uganda and make inferences about what this means for economic growth. Section 4 studies the industries that could emerge given Uganda's current capabilities.

Section 5 presents the key issues that constrain Uganda's economic development and diversification. These issues include previously identified constraints, weaknesses in institutional structures for public and private sector problem solving, and the potential resource curse. The section also presents recommendations for institutional structures to improve problem solving as well as policies for mitigating the effects of a resource curse. Finally, section 6 concludes.

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2. BACKGROUND ON ECONOMIC COMPLEXITY AND THE PRODUCT SPACE

Economic complexity

The foundational models of trade theory suggest that the initial pattern of specialization has little to no effect on its future evolution, as it is merely a reflection of deeper underlying characteristics of the country, such as factor endowments and technological differentials. In these models, the structure of the product portfolio of a country does not create sources of path dependence. Nevertheless, a recent series of papers (including Hausmann, Hwang and Rodrik, 2007; and Hidalgo and Hausmann, 2009) have shown that the productive structure does matter for growth and Hausmann and Klinger (2006) and Hidalgo et al (2007) have shown that this occurs because what a country produces today affects what it could produce tomorrow. To establish the intuition behind this idea, the game of scrabble is a useful analogy, as discussed by Hausmann et al. (2011) in the A*tlas of Economic Complexity*.

"In scrabble, players use tiles containing single letters to make words. For instance, a player can use the tiles R, A and C to construct the word CAR or ARC. In this analogy, each product is represented by a word, and each capability, or module of embedded knowledge, is represented by a letter. We assume that each player has plenty of copies of the letters they have. Our measure of economic complexity corresponds to estimating what fraction of the alphabet a player possesses, knowing only how many words he or she can make, and how many oth   er players can also make those same words. Players who have more letters will be able to make more words. So we can expect the diversity of words (products) that a player (country) can make to be strongly related to the number of letters (capabilities) that he (it) has. Long words will tend to be rare, since they can only be put together by players with many letters. Hence, the number of players that can make a word tells us something about the variety of letters each word requires: longer words tend to be less ubiquitous, while shorter words tend to be more common. Similarly, ubiquitous products are more likely to require few capabilities, and less ubiquitous products are more likely to require a large variety of capabilities."

Thus there should be a negative relationship between the diversity of a country and the average ubiquity of its products, since both are indirect measures of the capabilities of each country. Figure 15 suggest that this is indeed the case. Relatively diverse countries (those that export a large number of products) make products that are made by relatively few other countries (they have low ubiquity).

Figure 15: Diversification and ubiquity
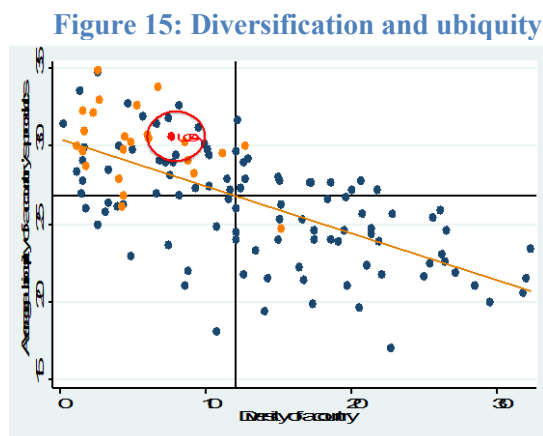
Source: Atlas of Economic Complexity

Uganda places in the upper left of the distribution; its diversity is fairly low compared to

all countries, but average when compared to other SSA countries (shown in orange). And in line with our theory, the products that Uganda produces are fairly ubiquitous.

However, diversity and ubiquity are imperfect measures of how much knowledge a society possesses. Diamonds for example have low ubiquity but this is not because they are complex. Rather, it is because diamonds are present in countries due to geographic fortune or luck. If diamonds were complex the countries making them would have many scrabble letters and hence should be able to make many complex products. Since Botswana and Sierra Leone don't, this tells us that diamonds are not complex. To address this problem, diversity can be used to correct the information carried by a product's ubiquity, and ubiquity can be used to correct the information carried by a country's diversity. We can repeat this "correction" an infinite number of times. The process generates a quantitative measure of complexity.

For countries, we refer to this as the Economic Complexity Index (ECI) and the corresponding measure for products gives us the Product Complexity Index (PCI). The Technical Appendix provides an explanation of how these variables are created. The PCI is a number unique to each product that captures how much productive knowledge the product requires. The ECI is a number unique to each country that measures the amount of productive knowledge contained in the country. Countries with a high ECI are well diversified countries exporting, on average, high-PCI products.

So, how complex is Uganda? Using UN COMTRADE data for 2010, Uganda ranked as the 102nd most complex out of 128 ranked countries in the world (it ranked as the 10th most complex country out of the 25 in SSA).

Why do we care about a country's complexity? The ECI does not only carry information about the productive knowledge of countries but has implications for income and future growth. Figure 16 shows the correlation between GDP per capita and the ECI, controlling for a country's natural resource rents (as countries with natural resources can be rich without being complex). It shows that economic complexity can explain about 75 percent of the variation in income; countries with high ECI tend to have higher per capita income.

Figure 16: Economic Complexity and Income
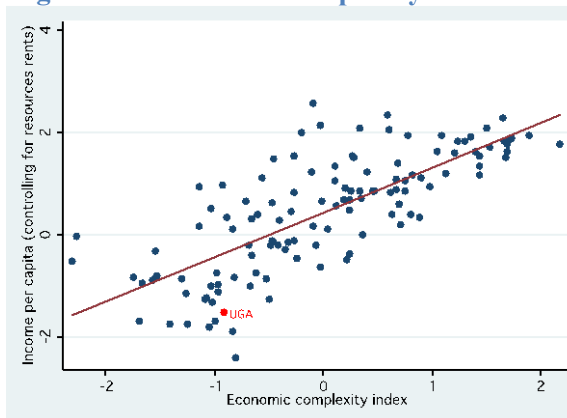
Source: Atlas of Economic Complexity

This finding is remarkable because the ECI uses absolutely no data on income, prices, or other measures of wealth. It only takes into account how many products a country makes and how many other countries make those products. Uganda appears significantly below the prediction line, indicating that it has a relatively high level of complexity for its level of income.

The relationship between income and complexity, however, goes further. Figure 17 shows that countries whose economic complexity is greater than what we would expect, given their level of income, tend to grow faster than those that a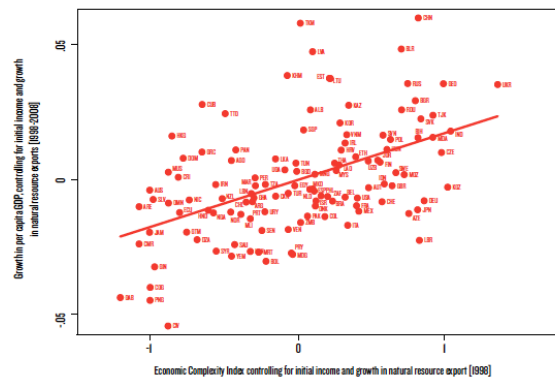re "too rich" for their current level of economic complexity. Thus, given Uganda's relatively high economic complexity for its level of income, we would expect it to grow rapidly in the near future. In this sense, economic complexity is not just a symptom or an expression of prosperity, it is a driver.[1]

Figure 17: Complexity and GDP growth

Source: Atlas of Economic Complexity

The Product Space

We now know that a country's income is affected by the productive knowledge that it holds. However, expanding productive knowledge requires the simultaneous expansion of the industries that use it. This gives rise to a "chicken and egg" problem where there are scant incentives to accumulate new productive knowledge in places where the industries that demand it do not exist. And it is impossible to develop new industries if the requisite productive knowledge is absent. To solve this problem, countries tend to move from products that they are making to new products that are nearby in terms of the productive knowledge they require. Arguably, it is easier to move from shirts to blouses than it is to move from shirts to engines. This is because, in terms of productive knowledge, shirts are more similar to blouses than to engines.

A testable implication of this hypothesis is that countries will diversify by moving from the products they already produce to others that require similar productive knowledge. Hausmann and Klinger (2007) investigated this hypothesis and formulated the concept of a product space in which the distance between products is a measure of the difference in the productive knowledge required to make them. The Technical Appendix provides an explanation of how the distance between products is calculated.

Intuitively, if two products are close or similar in terms of the productive knowledge they require, countries that are able to make one should also be able to make the other.

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[1]It is important to note what the Economic Complexity Index is not about. First, it is not about export-oriented growth. Although we calculate the ECI using export data, the channel through which it contributes to future growth is not limited to its impact on the growth of exports. It has been shown that the contribution of the ECI to future economic growth remains strong after accounting for the growth in real exports. Second the ECI is also not about openness to trade: the impact of the ECI on growth is essentially unaffected if we account for differences in the ratio of exports to GDP. Third, the ECI is not a measure of export diversification. Controlling for standard measures of export concentration, such as the Herfindahl-Hirschman Index, does not affect the results. Fourth, the ECI is not about a country's size. The ability of the ECI to predict growth is unaffected when we take into account a country's size, as measured by its population.

Empirically, similarity is measured as the likelihood that a pair of products is co-exported. That is, the probabilities that pairs of products are co-exported by countries carry information about how similar these products are. If two goods require roughly the same knowledge, this should show up in a higher probability of a country having comparative advantage in both products vis-à-vis other countries.

Figure 18 shows the visual representation of the product space using international trade data for the years 2006-2008. Each node is a product and its size is determined by its share of world trade. Two products are connected by links based on their probability of being co-exported by countries. The higher this probability, the thicker and darker is the link between the products.[2] These links define the structure of the product space. In turn, this structure is what affects the ability of countries to move into new products. Products that are close together share most of the requisite capabilities. As such, countries will find it relatively easy to move to nearby products. Thus, the product space implies that the process of accumulating productive knowledge is not random but rather path dependent. The products that a country produces today define what it may be able to develop in the near future.

Figure 18: The Product Space
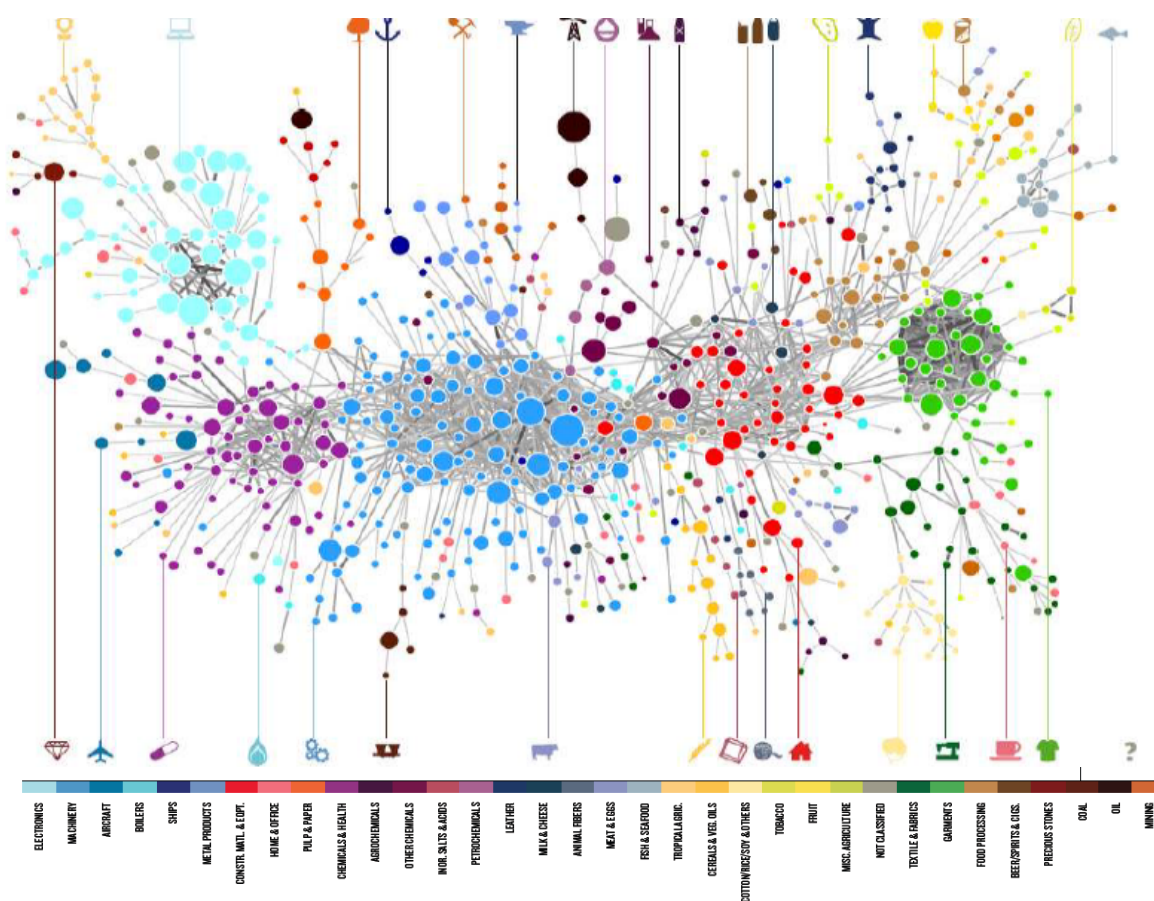
Source: Atlas of Economic Complexity

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[2]In order for the network representation to remain legible, only the links above a certain probability threshold are shown.

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The color of each product node corresponds to what we define as a product's "community": collections of products which naturally group together in the product space because they tend to be connected to each other more frequently than to products outside of the community. Communities form when they share a common set of distinct productive knowledge. This idea is somewhat different from the idea of industries or clusters as being vertically related through input-output connections in the value chain. In the product space, even if two products are closely connected in the value chain, they could easily belong to two distinct communities because they require different productive knowledge and can be readily transported and stored. For example, while textiles are part of the garments value chain, the capabilities required to competitively make textiles are quite distinct from those required to make garments, and thus they form two distinct communities.

Figure 19 demonstrates the different characteristics of the communities of the product space. Above we described how a product's complexity can be used to capture how much productive knowledge the product requires. Similarly, the figure shows the average complexity or embodied productive knowledge of the different communities. Above we also described how the structure of the product space defines the ability of countries to move into new products. A highly connected patch of the product space, therefore, makes the problem of growing the complexity of an economy easier. Conversely, a sparsely connected patch of the product space makes it harder. This means that products and their communities differ not only in complexity, but in how connected they are. We can think of this "connectedness" as the "opportunity value" of being located in a certain portion of the product space. Opportunity gain is therefore the value of moving to other products based on their connectedness to other products. The Technical Appendix provides an explanation of how this variable is calculated.

Figure 19: Community characteristics
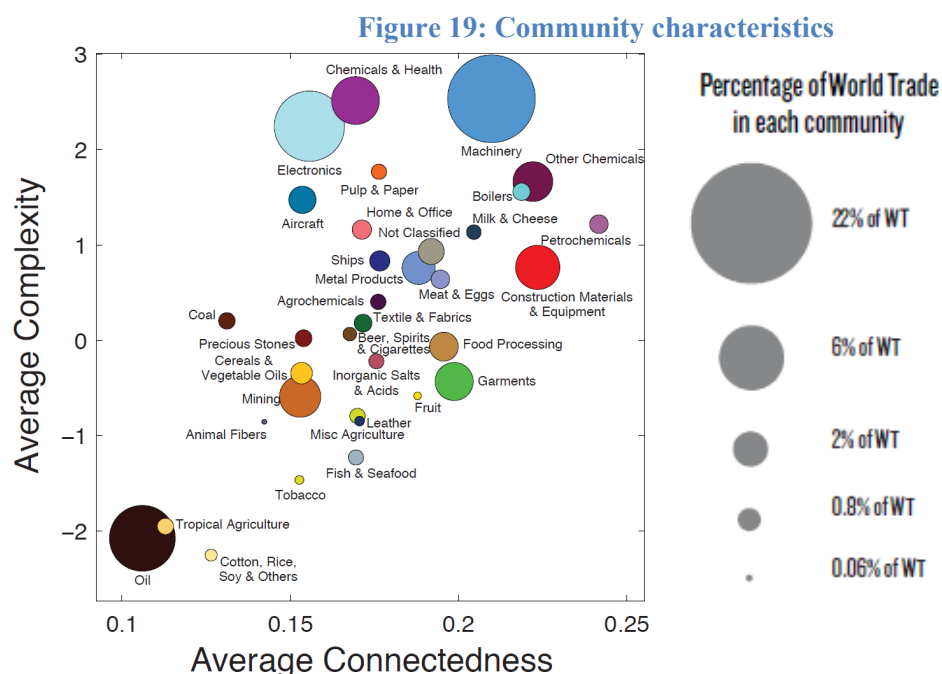
Source: Atlas of Economic Complexity

In Figure 19 we see that the more complex communities are generally more connected. This means that as countries diversify into more complex products, they also increase their opportunities for further diversification. For example the machinery and the various chemicals communities are highly complex as well as highly connected. The construction material and equipment community also offers a high level of connectedness, but a lower level of complexity. These communities' connectedness can be seen in the map of the product space, as they are located in the most central and dense areas. The figure also shows another advantage of these communities – their large size in world markets. This means that entering these communities offers opportunities to diversify into more products and into products with higher global demand. Conversely, another large community – oil – exhibits both the lowest complexity and connectedness score. This is also apparent in the map of the product space where oil products are linked to only one other product and to only one other community (petrochemicals).

Figure 20 shows the relationship between connectedness or opportunity value and economic complexity at the country level. This figure illustrates that countries with low ECI have few rewards to knowledge accumulation. This is because they have few scrabble letters and this limits the potential combinations of things they can make if they were to acquire more letters. Also, the products they make tend to be peripheral in the product space and have no nearby neighbors. Countries with high levels of productive knowledge also have low rewards because they already occupy a large fraction of the better part of the product space.

Figure 20: Uganda's position in the product space
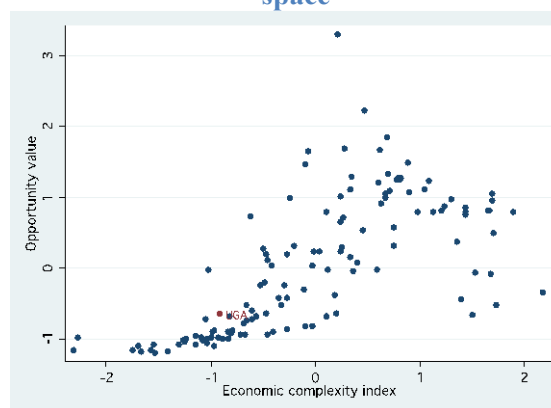
Source: Atlas of Economic Complexity

However, countries with an intermediate level of complexity differ widely in their opportunity value. For its level of complexity, Uganda's opportunity value is slightly above average. This combination of a relatively high ECI given its level of income (as discussed in section 2) and a moderately high opportunity value given its ECI suggests that Uganda is in a good position to achieve diversification and economic growth. Indeed, using these measures in the *Atlas of Economic Complexity*, Hausmann and Hidalgo et al. (2011) find that Uganda ranks 1st out of 128 countries in terms of expected total GDP growth to 2020. (However in terms of per capita growth Uganda ranks 24th, due to its high projected population growth rate.)

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3. THE ECONOMIC COMPLEXITY AND DIVERSITY OF UGANDA

Uganda's exports are concentrated in agro-based commodities such as coffee, tobacco, tea and cocoa (Figure 21). Although exports have become more diverse over time, this has been mostly due to diversification into other primary products such as mining and fish. There has also been an increase in exports of light manufactured building materials including cement and steel products especially to the neighboring countries.

Figure 21: The evolution of Uganda's exports over time
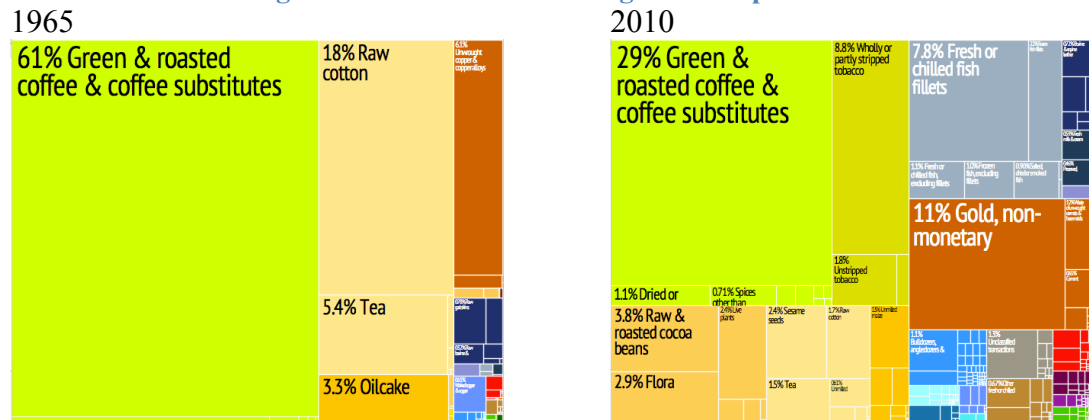
Source: Observatory of Economic Complexity
Note: Each product's size gives its share in the export basket; color denotes community.

Uganda's position in the product space is shown in Figure 22. As above, Uganda has a significant presence in many of the peripheral communities, particularly, tree crops and flowers, as well as food processing, animal products and fish and seafood. Yet Uganda has made few inroads into the larger, more complex, and more connected communities such as garments, construction materials, chemicals, and machinery.

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Figure 22: Uganda's location in the product space

Source: Atlas of Economic Complexity
Note: The darkly shaded products are those which Uganda exports with comparative advantage

Figure 23: Uganda's export destination, 2010

Having examined Uganda's diversification by product, we also look at Uganda's diversification by destination. Exports in the initial post-independence period went primarily to Western Europe and the United States. However, Uganda's export market has begun to diversify owing to the increase in production of non-agricultural products, and the increase in demand for such products from local markets in Sub-Saharan Africa, as well as the Middle East and Asia (Figure 23).

Source: Observatory of Economic Complexity

These new markets are particularly important because they demand Uganda's more sophisticated products. Exports to Europe are dominated by agriculture, whereas exports to

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Asia and the Middle East also include fish and animal products. But the local African market is by far the most diversified and also includes exports of machinery, construction materials and equipment, chemicals, and food processing (Figure 24).

Figure 24: Uganda's exports by market and community

Community	Europe	SS Africa	Middle East	Asia
	% total			
Agriculture	76%	55%	62%	64%
Animal	0%	8%	1%	18%
Chemicals	0%	4%	0%	1%
Construction	0%	5%	0%	1%
Electronics	0%	2%	0%	1%
Fish & Seafood	20%	1%	34%	13%
Food Processing	2%	4%	1%	0%
Garments	0%	2%	0%	0%
Machinery	0%	13%	0%	0%
Metal products	0%	3%	0%	0%
Other	1%	5%	1%	2%
Total US$ millions	408	155	24	78

Source: Own calculations based on COMTRADE data

As exports are growing as a percentage of GDP in Uganda, trends in global trade will become increasingly important. Over the past decade, two major trends have already taken place. First, global trade volumes have continued their exponential growth, and second, developed countries have lost market share, both as importers and as exporters of traded goods, to developing countries. Importantly, both of these trends are likely to continue.

Figure 25: Expected growth in imports
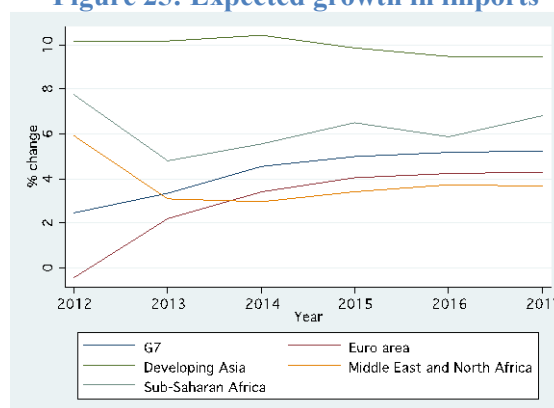
Source: WEO

Figure 25 illustrates the IMF's World Economic Outlook projections of imports for different country groups. The key message to be drawn from these numbers is that Uganda would do well to continue diversifying its exports towards SSA and Asia, as these are expected to be the fastest growing import markets.

4. AVENUES FOR DIVERSIFICATION

As noted Uganda has already taken some steps to diversify its exports. This process may have been hastened by falling prices for Uganda's main agricultural exports – coffee, cotton and tea. However, the bulk of this diversification has been into other peripheral primary products, particularly fresh fish. That being said, some non-traditional industries, such as cut flowers, plastics and metal products are also increasing their exports, albeit from a low base.

For Uganda to sustain economic growth per capita in the face of a rapid population growth, this process of diversification must accelerate. In this section, we develop methodologies to explore the set of potential new products that are feasible for Uganda.

Efficiency frontier

One way to evaluate Uganda's possibilities in the product space is using our measures of distance, complexity and opportunity gain. These measures can be used to map Uganda's efficiency frontier as shown in Figure 26. The first graph plots the 762 products in the product space, where the position of each product (circle) is defined by its complexity (vertical axis) and its distance from the current productive knowledge of Uganda (horizontal axis). The second graph is similar, except the vertical position of the products is now given by its opportunity gain. In both charts, the preferred products would lie in the top left corner of this figure – high complexity or opportunity gain, but not too far away from Uganda's current productive knowledge. However, stark tradeoffs are apparent between the desired qualities of products. That is, more complex products, and those with higher opportunity gain are generally more distant, and therefore more difficult to develop.

Deciding how to diversify Uganda's production involves taking into account these tradeoffs. One way to do this is to create a diagonal cut-off line that balances the objectives of higher complexity or opportunity gain and lower distance (selected products lie to the left of these lines).[3] In the first chart we also define a horizontal cut-off line which represents Uganda's current average level of economic complexity (-0.5). New products should serve to increase Uganda's overall economic complexity. In the second chart we also impose the condition that the opportunity gain be greater than zero. In this way we do not consider products Uganda already produces with a comparative advantage, as these would not help diversification.

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[3]We define this line by connecting the two points that represent the intersection of the 25th percentile of complexity and distance and the intersection of the 75th percentile of complexity and distance. The aim is to generate a frontier whereby products that are very distant (e.g. at the 75th percentile of distance) will be desirable only if they are also very complex (e.g. at the 25th highest percentile of complexity).

Figure 26: Uganda's efficiency frontier, by product
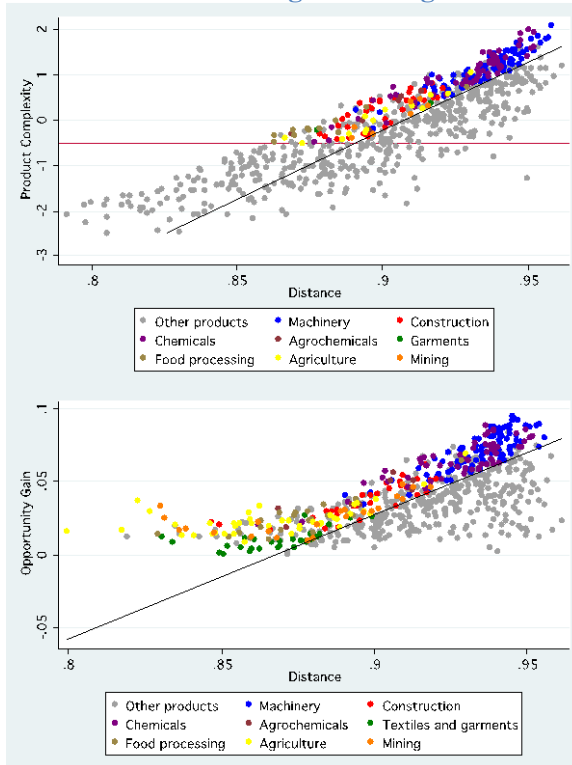
Source: Own calculations based on the Atlas of Economic Complexity and COMTRADE data

Figure 27 also displays Uganda's efficiency frontier, but at the community rather than at the product level. In this figure the size of each node is proportional to world trade; the fraction of each bubble in white represents the percentage of goods in that community that are exported by Uganda (with a comparative advantage) and the dashed gray line indicates the average economic complexity of Uganda's exports.

Figure 27: Uganda's efficiency frontier, by community

Source: Calculations based on the Atlas of Economic Complexity and COMTRADE data
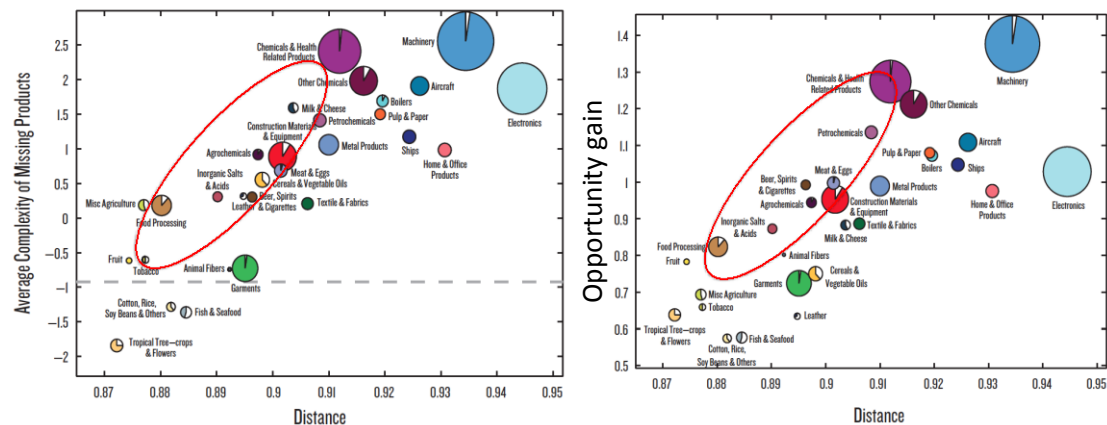
These different depictions of Uganda's efficiency frontier provide a clear picture of its choices. Above Uganda's current average level of complexity, the closest community

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along the efficiency frontier is **food processing**. Further Uganda already has some presence in this community. **Construction materials and equipment** is the next community along the efficiency frontier. Importantly, this community offers a sizable opportunity value without being prohibitively distant. Other communities, such as garments, offer sufficient opportunity gain, but do not represent an improvement over Uganda's average level of complexity. While others such as metal products and textiles are either less complex for the same distance, or more distant for the same complexity. Finally, some communities, such as machinery and chemicals, offer both high complexity and a large opportunity value, but they are prohibitively distant given Uganda's current productive knowledge.

Strategies

The analysis above has allowed us to map the set of potential new products that are feasible for Uganda taking into account the trade-offs between distance, complexity, and opportunity value.

Another potential trade-off exists between creating more jobs versus better jobs. Our analysis of the demographics of Uganda has already shown that creating jobs outside agriculture will be imperative to the development of the country and to preventing increasing poverty levels. Ultimately however, countries need jobs for the citizens they have, not for the citizens they wish they had. If there are many under-employed low-skilled rural workers, industries with lower levels of sophistication may still be the best employment alternative for them. Abandoning industries too early may move workers into unemployment or into lower productivity activities in the informal sector, lowering the overall productivity of the economy. At the same time, developing sophisticated industries that can afford to pay higher wages, creates jobs for higher-skilled workers and can lead to an environment of rising equilibrium real wages. In order to balance this tradeoff, consider the following two strategies.

- *Parsimonious transformation* – The strategy emphasizes industries that are in the vicinity of a country's current set of capabilities but that have higher sophistication, thus making the development of the new products faster and less risky. In particular, this strategy should emphasize labor-intensive industries.
- *Strategic bets* – This strategy emphasizes sectors that are more sophisticated and provide a larger strategic value, even if they lie at significantly greater distance. These industries are important for driving economic growth, further diversification and urban job creation.

The strategies can be brought to the data by developing summary indexes that take a stand regarding the relative importance of different goals. We do this by normalizing[4] the three variables of concern – distance, complexity and opportunity gain – and creating summary indices that reflect different goals. The parsimonious transformation index prioritizes distance; while the strategic bets index prioritizes complexity and opportunity gain while accepting products that lie at a greater distance (Figure 24-1). In order to

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[4] Normalization creates a new variable with mean of zero and standard deviation of 1. Note that this process allows for a valid comparison within each country, but cannot be used to compare countries, because normalization takes account of the specific within country variation.

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further focus on the most viable products we exclude all products with an opportunity value of zero, with a distance greater than the average, or with a complexity score in the bottom 25 per cent.

Figure 24-1: Strategies

Weights	Distance	Complexity	Opp. gain
Parsimonious transformation index	0.6	0.2	0.2
Strategic bets index	0.2	0.4	0.4

Parsimonious transformation – Examining the top ranking products we find that they are mostly processed inputs or outputs of the agricultural industry, that is, food processing and agrochemicals (Figure 29). This is unsurprising given that Uganda's current productive structure is dominated by agriculture.

Figure 29: Products for parsimonious industrial policy

Product	Distance
Food processing	
Margarine etc.	0.86
Confectionery, non-chocolate	0.86
Jams, jellies, marmalades, etc.	0.86
Edible products and preparations, nes	0.87
Fruit, temporarily preserved	0.87
Other materials of vegetable origin, nes	0.87
Tobacco, manufactured	0.87
Bakery products	0.87
Plastic packing containers and closures	0.87
Fixed vegetable oils, nes	0.88
Cigarettes	0.88
Packing containers of paper	0.88
Beer made from malt	0.88
Bottles etc of glass	0.88
Flour and meals of fruit and vegetables	0.88
Vegetables, frozen or in preservative	0.88
Non-alcoholic beverages, nes	0.88
Insecticides	0.87
Fertilizers, nes	0.87
Propellant powders and other explosives	0.87

Strategic bets – Examining the top ranking products we see that they represent mostly construction and industrial materials such as plastics, metal and paper products (Figure 30). Although many of these products are bulky and thus expensive to transport for a landlocked country such as Uganda, there is a market for these products in neighboring

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East African countries, where its geographic location constitutes an advantage rather than a disadvantage.

Figure 30: Strategic bets

Product	Distance
Construction and industrial materials	
Printed matter, nes	0.91
Varnishes and lacquers; distempers etc	0.90
Miscellaneous articles of base metal	0.91
Paper and paperboard cut to size or shape, nes	0.90
Wadding, wicks and textiles fabrics for machine use	0.91
Aluminum and alloys, worked	0.90
Structures and parts of, of aluminum;	0.91
Wood packing cases, boxes, cases, crates, etc	0.90
Metal casks or drums for packing goods	0.90
Trailers and transports containers	0.91
Articles of paper pulp, paper, paperboard, nes	0.90
Polyvinyl chloride	0.91
Polyethylene	0.90
Structures and parts of, of iron, steel	0.90
Builders` carpentry and joinery	0.90
Printed books, pamphlets, maps and globes	0.91
Gauze, cloth, grill, netting, reinforced fabric, etc	0.91
Plastic packing containers and lids	0.87
Fibre building board of wood or vegetable material	0.89
Paper and paperboard, creped, crinkled, etc	0.89
Other sheet and plates, of iron or steel, worked	0.91
Polypropylene	0.90
Packing containers, box files, etc, of paper	0.88
Construction materials of cement	0.89

This analysis shows that the opportunities of Uganda are more ample than those that would emerge if it were to concentrate exclusively on adding value to its existing raw materials, a strategy that has been all too common in Africa. The international evidence shows that countries diversify by moving into products that use similar productive knowledge, not necessarily the processing of existing raw materials.

An illustrative case is the failure of the cotton garments industry in Uganda (see World Bank, 2007). While this industry provided the opportunity to add value to Uganda's raw cotton, it proved too distant from Uganda's position in the product space. Consider the

productive knowledge required to grow cotton: understanding of weather, soils, seeds, and harvesting etc. This knowledge is far removed from that required to operate the machinery to produce cotton textiles, or that required to manage a factory of garment workers.

5. ISSUES AND POLICY PRESCRIPTIONS

Figure 32: Electricity Consumption and GDP

Source: CIA World Factbook, 2011-2012

Economic development in Uganda faces constraints from the limited availability of necessary public goods and factors of production. Underlying these constraints are inadequate institutional structures through which the government and private sector can interact to identify and solve problems. In addition to current constraints, an oil boom in the near future may create macro-economic conditions that constrain Uganda's economic diversification. In this section we examine each of these issues Uganda faces and provide policy recommendations to address them.

Currently Identified Constraints

Constraints to investment in Uganda have been previously articulated in the National Development Plan for 2010/11-2014/15. The NDP identified constraints from inadequate access to finance, low availability of skilled workers, and poor infrastructure especially regarding the supply of electricity.
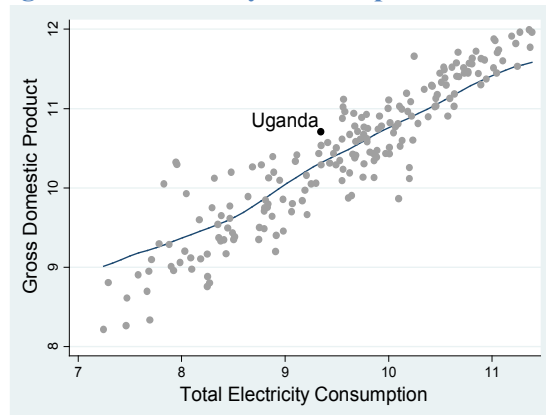
Figure 31: Interest Rates and Credit, SSA

Limited Access to Finance – Getting access to finance remains a constraint to firms' ability to grow and potentially to innovate into new products. Average lending rates have been in the range of 20-30 percent in Uganda. Most lending is largely short-term and therefore not suitable for long-term investments needed to produce new products. Figure 31 shows Uganda's interest rates are high in comparison to other SSA countries after accounting for inflation.

Source: WDI, most recent year available

Lack of necessary skills – The current scope of vocational training remains limited to traditional courses like carpentry, civil work masons, and electrical foremen. If the economy is to diversify into new and more complex products, specialized new skills will be required. To address a skills shortage, vocational training can be improved and targeted for diversifying industries. However, such training is unlikely to solve a skills shortage on its own. It is difficult ex ante to identify all of the skills a new industry will need. Furthermore, training a workforce to master a skill without having an existing cadre of experts in that skill may be putting the cart before the horse. Therefore, facilitating immigration of skilled workers will be an important part of overcoming a skills constraint. This can also help address resource course issues as discussed in that section below.

Inadequate physical infrastructure – Infrastructure remains one of the key constraints to economic activity in Uganda. Figure 32 Shows that Uganda's economic output is high relative to electricity consumption, which suggests the economy is getting the maximum production out of its current level of electricity consumption and that electricity provision will need to improve for GDP to grow further.

The government has acknowledged this obstacle and has reoriented its focus by allocating more resources to further develop the energy and roads sector. Arrangements with independent power producers (IPPs) can further enhance the provision of electricity. IPPs can be an integral part of planning for industrial zones. This would allow the government to focus more investment into roads, which require planning and budgetary resources at a national level. The role of industrial zones is discussed further in following sections.
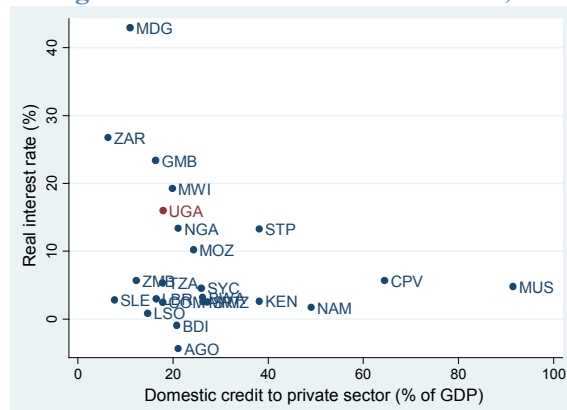
Institutional Weaknesses for Identifying and Addressing Constraints

The above issues are not an exhaustive list of constraints in Uganda. There are simply too many possible constraints that require more information than any external actor can supply. To illustrate, consider what inputs are required for a thriving manufacturing sector: power, water and water treatment, roads, ports, airports, security, medical services, day care centers, labor training, banks, other suppliers, customers, worker safety, environmental law, consumer protection, corporate law, property rights, social security, labor training, labor standards, and certification of standards etc. Because firms that are investing in productive activities are best placed to identify the specific constraints they face, we recommend improving the institutional structures for firms to work with the government to identify problems and find solutions.

According to traditional theories of industrial policy, government intervention is justified in the rare cases where market distortions prevent prices from signaling real marginal social costs. Thus the policy solution is to design taxes or subsidies that can reduce the identified price gaps. Drawing on some recent research, we depart from this intellectual tradition and note that production requires many publicly provided inputs. Even with a subsidy, if a public input is missing, productivity in the private sector will remain low and subsidies will be ineffective at promoting a sector's growth. Therefore, industrial policy should not simply attempt to make chosen "winners" more profitable through subsidy or tax policy, but instead promote industries by identifying and providing the missing public inputs and policies that sectors cannot purchase in the marketplace and that they need to grow.

Because the problems the private sector faces are myriad and unpredictable, and because firms in the economy are best positioned to know the problems they face, it is important that the government has mechanisms to interact with the business community to understand their problems. Various forums exist in Uganda for government and the private sector to interact. These include: the National Competitiveness Forum, the Presidential Investors Roundtable and the Private Sector Forum, National Competitiveness Forum. There are also various business organizations that have formed to give stronger voice to the business community's needs.

However, Kjær and Katusiimeh (2012) show that previous efforts of the government to work with the private sector to promote economic development have produced relatively few successes. The authors find that "In general, the governments' policies towards the industrial sector has been either non-existent or ad hoc and aimed at particular enterprises whose political support has been important" (pp 28). One reason for the lack of successful interventions is that roundtable forums on their own are not enough to carry out reforms and provide public inputs. Acting on information to relaxing constraints requires state resources and institutions that are dedicated full time to problem solving and coordinating government action.

Golooba-Mutebi and Hickey (2013) point out that institutions and state capacity in Uganda are inadequate to support structural transformation and diversification. There are several specialized institutions whose intended role is to support and stimulate industrial development. These institutions include, for example, the Uganda Industrial Research Institute which is a lead agency for industrialization established by an act of Parliament of Uganda. Its mandate is to undertake research and to develop appropriate technology in order to create a strong effective and competitive industrial sector in Uganda. Despite the well intentioned mandate of these agencies, the challenge has been to respond to the changing needs of the private sector and the challenges they face in adoption and assimilation of new technologies. Furthermore, coordinating complementary reforms or inputs from other government agencies further complicates the task.

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The recommendations for industrial policy in this paper focus on solving the meta-problem of identifying constraints. We suggest reforms to re-structure the interaction between the private sector and government, as well as the coordination between government agencies that are responsible for addressing constraints. The goal is to strengthen domestic institutions' ability to undertake an iterative process of identifying and relaxing constraints in a precise and expeditious manner. This stands in contrast to an approach that relies on a few external analyses to identify constraints. Such an approach would deal with too few possibilities and require input and feedback loops that are too long to be practical, especially for the development of nascent industries.

Our approach can be seen as an application to industrial policy of the Problem Driven Iterative Adaptation (PDIA) approach to government reform outlined by Andrews, Pritchett and Woolcock (2012) and examined in Uganda's context by Andrews and Bategeka (2013). The application of PDIA principles include:

- Problem driven: much of the policy recommendations below are intended to improve the process of problem identification and to focus reform effort around identified problems.
- Feedback on outcomes: the recommendations below provide mechanisms for identifying whether an attempt to address a constraint is effective.
- Adapt and iterate: ensuring institutions can adapt to feedback on what is and is not working is critical.

Our approach is to employ the PDIA philosophy for building institutional mechanisms that promote a constructive collaboration between the public and private sectors. The reforms identified below are intended to widen the capacity of government agencies to collect and act on information about missing public inputs. These policies should also address the problem of making incentives for all actors as consistent as possible with the public interest. And finally, we also recommend policies that bring together similar firms geographically, in order to more easily coordinate the provision of the needed public inputs.

Public-private bandwidth – Firms need the cooperation of government in providing critical public inputs, but the government also requires the cooperation of firms and entrepreneurs to identify opportunities and obstacles and to address them. As firms analyze potential investments or operate production units they identify inefficiencies and obstacles that impede particular lines of business. In doing so, the private sector thus acquires knowledge that is indispensable to the government in identifying and eliminating high dimensional, non-monetizable distortions (Hausmann et al, 2008).

Thus a key element to our industrial policy is increasing the bandwidth of communication between the public and private sectors. By this term we mean the frequency and detail of the information that gets exchanged between the two kinds of organizations. To do so we increase the set of opportunities through which information is exchanged. This can be done in two ways.

First, by promoting permanent working groups around solving the common problems faced by existing industries, organized at the appropriate level of aggregation. Too high a level of aggregation is undesirable as it encourages firms to lobby for broad government aid, like a tax holiday, instead of focusing on the identification of industry-specific public inputs. Of course, too narrowly defined forums would be unmanageable. Thus, the ideal approach would be for the business groups to self-organize. The fact that participation would lead to the supply of public inputs should be enough of an incentive to elicit participation. However, there may be a case for the government to provide some seed support to overcome free-rider problems (Hausmann et al, 2008).

A second approach is to create open windows where any actor, including new ones, may interact with a government entity and exchange information. Development banks for pioneers would have this characteristic. They potentially offer a certain kind of service to whoever shows up with a business plan.

Venture capital fund – A venture capital fund can further enhance the government's ability to understand the issues and constraints faced by the private sector. By targeting loans to pioneering firms, the government can gain unique insights into the areas the market is finding feasible. The interaction with firms provides an opportunity to gain information about the constraints that limit their growth. In addition to a loan officer, each loan should have a "knowledge officer" assigned to ensure that information on constraints flows to government agencies that can take action.

Annual competitiveness bill – For the private sector to participate in identifying distortions and problems, they need some assurance that the government will act on the issues raised. Private sector actors are busy people that will not participate in useless exercises that lead nowhere. One way to commit to change and to provide deadlines is to create an annual process in which regulatory and institutional changes identified by the working groups will be included in an annual competitiveness bill. The groups that finish their work on time will have their proposals considered for inclusion in the bill. Those that do not will need to wait a year to have their proposals considered.

Proposals should be public knowledge. This will discipline the nature of the acceptable "ask". In considering a proposal, the government's technical secretariat that would be appointed to manage this process should make its determination based on the public interest, not private profits, and should improve the present value of net government revenues, as the expansion of production generates future taxes. Requests should be for public inputs, not private subsidies. The secretariat's assessment should also be public knowledge to ensure transparency and accountability.

Inter-governmental coordination – Even when public and private sector cooperation leads to clearly identified problems that are understood by the government, coordinating government action to address them can be problematic. One issue that often occurs is that the government department that identifies a problem is different from the one that can provide a solution. In these cases, solving the problem identified by the first department may not be a priority for the second department that must make choices with limited

resources. Hence, problems are identified but not solved.

A market-like mechanism that structures the interaction between government agencies that demand solutions and agencies that supply solutions is a useful way to address this issue. A centralized fund can be made available for agencies that are in need of solutions to apply for and then allocate to agencies that can supply solutions. This addresses the government coordination problem by augmenting the resources available to executing departments beyond their allocated budget in response to identified needs and demands on these departments. For example, a private forum of food-processing firms dealing with the Ministry of Agriculture may propose the need for a refrigerated hanger at the airport or better feeder roads. The Ministry of Agriculture would then submit a proposal for funds from the central budget, and have those resources assigned to the relevant executing department.

Industrial zones – Unless the government is able to assure that the necessary inputs provided by its various agencies happen to coincide all at the same point of space and time, productivity will be low. In most developing countries providing all things in all places is impossible, but providing them somewhere is more doable. Thus industrial zones are a useful solution for creating areas where all the requisite inputs are available and hence activities can achieve high productivity. Clustering activities in an industrial zone facilitates the provision of the requisite public inputs. In addition, it allows firms to benefit from externalities such as knowledge spillovers and scale economies.

Industrial zones can also facilitate public private dialogue. In renting industrial space and interacting with investors, zone managers are able to identify missing public inputs. Subsequently, they have the backing of firms in the zone in lobbying the government for solutions.

It is important to note that countries are not constrained by the resources of the government in establishing industrial zones. In many cases, industrial zones have been developed as public-private partnerships, or as private ventures. Just like any other large construction project, industrial zone developers are able to receive a return on their investment by charging rents to firms who wish to locate in the zone. They can internalize the economies of agglomeration in the price of rentals. For example, there are around 50 privately owned industrial zones in the Dominican Republic. These zones compete for rental income by providing better quality services to firms. The result is that most industrial zones tend to provide high quality infrastructure, a friendly and competitive business environment, and services at lower cost due to economies of scale (Hausmann et al, 2008).

Of course, investors may perceive building an industrial zone as an excessively risky venture, due to the large up-front costs and uncertain returns. One way to encourage private investors is for the government to engage in a joint venture, whereby they guarantee the first 'x' number of years rent in the zone. This has the added benefit of incentivizing the government to seek out and attract new firms and industries to the zone so as to save on the guarantee. If the government is successful in doing so, the financial

cost of the guarantee can be quite minimal. The Irish Industrial Development Agency has successfully used this approach.

Principles for Engaging in Industrial Policy

Implementing industrial policy is often challenged by an environment of pervasive rent seeking and corruption. Thus our final recommendation is to discipline and direct the entire process described above with a set of operational rules and principles. They include:

1) Legitimacy: Interventions must be shown to be in the public interest and result in a positive net present value for government. Thus projects should be chosen to increase productivity, not to compensate sectors for their low productivity. For industrial policy to be sustainable, it cannot be perceived by the majority as a subsidy program for the already rich, but rather as in the public interest.

2) Focused on public inputs and spillovers: Interventions should focus on providing public inputs, not private subsidies. Interventions should pass some process in order to guarantee that they solve problems for as wide a potential set of activities as possible thus maximizing spillovers. This means a focus on increasing productivity instead of profitability as profitability can be achieved through undesirable protections that make competitors, suppliers, consumers, or the tax payer poorer.

3) Co-financing: To assure that the intervention actually increases productivity, the private sector should be willing to co-finance it to demonstrate a willingness-to-pay amongst the private sector. In this way, the willingness of the private sector to co-finance can be a useful screening mechanism for potential interventions.

4) Transparency and accountability: Transparency principles and financial controls should be imposed in order to limit rent-seeking and increase legitimacy vis-à-vis the rest of society. There will have to be clear criteria for success ex-ante. In this way, nonperforming initiatives can be diagnosed early and either corrected or terminated. Similarly, the identification of success should lead to a process whereby an initiative may be re-designed or expanded in order to benefit more activities. Regular horizontal exchanges among deliberation forums and vertical exchanges between the central fund and the forums about what is working and what is not should be established to facilitate this process.

Oil on the Horizon, a Potential Resource Curse

Even if public inputs are well provided, the magnitude of Uganda's coming oil boom has the potential to create macroeconomic effects that hinder the economy's (non-oil) tradable sector and become a binding constraint to further diversification. Below we identify the predominant pathways through which an oil boom can become a constraint. In the next sub-section we provide policy recommendations for managing oil revenue in order to mitigate macro-economic distortions.

Dutch disease – An oil boom in Uganda will increase Foreign Direct Investment (FDI) as well as exports and tax revenues. While a lot of the investment is going to be translated into imported equipment and services, some will be invested in the local economy. Increased government revenue will increase domestic demand for both

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tradables and non-tradables. FDI and Oil revenues will allow for importation of tradable goods but the increased demand for non-tradables will have to be produced locally.

Under these circumstances, what will become binding will be the capacity to expand non-tradables. As the demand for non-tradables increases, prices and wages will increase in the non-tradable sector and labor will move from the tradable sector to the non-tradable sector thus making construction and services the dynamic parts of the non-oil economy. Since tradables can be elastically supplied from abroad but non-tradables will face labor and other constraints, their relative price will increase, which is another way of saying that the real exchange rate will appreciate. Real exchange rate appreciation makes the domestic production of non-oil tradables less competitive and will cause the sector to shrink - a phenomenon called the Dutch Disease.

The extent to which Uganda will suffer from Dutch Disease will depend on the magnitude and speed of the domestic spending of the additional oil income, on the elasticity of supply of non-tradables and on the extent to which the use of resources makes the tradable sector more productive. Fortunately, in Uganda, there are many people in rural areas who are working less than full time. This surplus unskilled labor could be engaged in the non-tradable sector thereby increasing output without increasing the relative price of non-tradables. If resources are used to improve roads, power, water, access to capital and imported inputs, the tradable sector may become more productive and better able to thrive, in spite of the increased demand for non-tradables. All this would help Uganda avoid Dutch Disease.

Skilled labor might be a tighter constraint on the growth of the non-tradable sector because rural labor is mostly unskilled. The countries of the Persian Gulf have shown that immigration can relax the constraints on skilled labor. Relaxing this constraint helps to make the supply of non-tradable goods and services more elastic and thus better able to respond to the increase in demand for non-tradables. This elasticity is crucial for avoiding real exchange rate appreciation. In addition to alleviating Dutch Disease constraints, skilled labor immigration can create employment opportunities for Uganda's unskilled rural work force. Rather than competing with employment opportunities for unskilled workers, skilled labor is a necessary complement to unskilled labor. Therefore, increasing the availability of skilled labor should improve employment opportunities for unskilled workers in Uganda.

As aid flows tend to subside in countries with significant growth in oil revenue, Dutch Disease in Uganda will also be dependent on the degree and manner in which oil revenues substitute for aid inflows. From a macroeconomic point of view, the effect on the real exchange rate will depend on the net increase in oil plus aid spending. Bategeka and Matovu (2011), show that increased oil revenues could indeed hurt the economy if not managed well through a real exchange rate appreciation that leads to a significant reduction in exports. From a microeconomic point of view, the relative increase in government spending versus aid spending also has potential consequences for Dutch Disease. Spending financed through aid goes through different governance and authorizing processes than spending from the government's own oil and other tax

resources. This may affect the quality of spending in one direction or the other. In order to ameliorate Dutch Disease effects, it is important that the quality of spending be as high as possible and directed to increasing the productivity of the tradable sector.

Volatility effects – Besides the impact of the level of spending of oil resources on the domestic economy, there are effects that come from the volatility of this spending. Since the oil price is fairly volatile, if spending follows the pace of revenues, as would be the case if the budget would be balanced on a yearly basis, then the volatility in revenues would be transmitted to the domestic economy. As argued by Hausmann and Rigobon (2003), this would also tend to shrink the tradable sector, just as with the Dutch Disease. The mechanism is as follows. The volatility in spending will cause volatility in the real exchange rate. Since investors are risk averse, they will respond to this additional source of uncertainty. However, the real exchange rate will have a bigger impact on the volatility of profits in the tradable than in the non-tradable sector. The reason is as follows. In the non-tradable sector, there is a positive correlation between the price of non-tradables and the real wage. Booming times will see a high non-tradable price and high real wages. Since wages are a cost to the sector, their rise will moderate the increase in profits caused by the high price of non-tradables. The opposite occurs in bust times, thus moderating the impact on profits also. By contrast, in the tradable sector there is a negative correlation between prices and wages. In boom times, wages are high but the real price of tradables is low because the real exchange rate is strong, making tradables cheap. In bad times tradables are expensive and wages are low making tradables more profitable. It follows that the profits of the tradable sector are more sensitive to volatility in the real exchange rate.

This effect causes a vicious circle. The more volatile the real exchange rate, the higher the relative risk of investing in tradables which causes the sector to attract less investment and to shrink. But a smaller non-oil tradable sector will make the real exchange rate more sensitive to the volatility in the spending of oil revenues. So, volatility in the real exchange rate makes the non-oil tradable sector smaller and a smaller tradable sector makes any fluctuation in oil spending cause a greater volatility in the real exchange rate. This positive feedback loop can continue until the non-oil tradable sector disappears completely.

This is more than a purely theoretical possibility. In 2010, Nigeria's oil exports were only 433 dollars per capita. But its non-oil exports were barely 15 dollars per capita. By contrast, Mexico had a similar level of oil exports, but its non-oil exports per capita were 139 times larger than Nigeria's. In the case of Norway, its oil exports were 33 times larger than Nigeria's. In spite of this abundance of oil, its non-oil exports were 653 times those of Nigeria. Hence, Nigeria exports almost exclusively oil, but not because it has so much of it. Rather, it is because oil has made the non-oil tradables very unattractive, in part because of the volatility it has historically generated.

Policies for Preventing a Resource Curse
Uganda will need a plan to manage revenue from the oil boom in order to avoid excessive real exchange rate appreciation and volatility. To address this, the government should make a credible commitment to a stable and competitive real exchange rate by setting a

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target for the non-oil fiscal deficit that does not respond to short-term fluctuations in oil revenues. This will give stability to spending and reduce both the Dutch disease and the inefficient specialization that originates from a volatile real exchange rate. This will ultimately lead to a more diversified economy.

In this context, the government has announced its intention to control the rate of growth of expenditure in the wake of windfall revenues in order to avoid "stop-go" public spending, and set up a Petroleum fund for the current and future generations. To be successful, it is important that budget institutions and the rules on the use of Petroleum fund resources be well established and followed. One common mistake, as it occurred in Colombia in the 1990s, is to force the government to generate gross savings of oil revenues in a fund, but without limiting the overall size of the fiscal deficit. The government actually increased overall spending even more than the oil boom, while still abiding formally by the rules of the oil fund. To avoid this, controls need to restrict the non-oil fiscal deficit rather than simply require savings of oil revenues.

The other difficulty of managing oil revenues is that controls often depend on projected oil prices and these can be subject to manipulation. In this respect, the rule followed by Kazakhstan has some advantages (see Hausmann, 2003). In that country, 100% of oil tax revenues goes into the fund and the rule determines how much of the fund money can be transferred to the budget in any year. The rules provide attractive short term and long term features and is further discussed in the technical appendix.

Increasing the elasticity of the supply of non-tradables will also be important. Policies that encourages the immigration of skilled labor, whether from neighboring countries or from farther away, will help to achieve this. The battle is already half won with the regional efforts of the East African Community (EAC) which aspires to make trade and labor mobility much easier among East African countries. The Ugandan government will therefore need to build on these efforts to facilitate skilled labor mobility into the country.

Finally, as the quantity of government expenditures will inevitably increase, it will be important that the quality improve as well to mitigate negative effects on the tradable sector. This makes the institutional reforms of previous sections especially important in the context of an oil boom to ensure that expenditures go to relaxing constraints and making the tradable sector more productive.

6. FINAL REMARKS

Uganda has had a distinguished economic performance over the past 2 decades and faces the promises of a more prosperous future. In order to realize its economic potential, Uganda must manage its opportunities wisely. Promoting economic development and further diversification will require addressing current constraints and improving domestic institutions for identifying and addressing constraints. It will also be necessary to manage future oil revenues to avoid macro-economic distortions that can constrain the tradable sector.

Uganda recognizes the importance of structural transformation and diversification, but its

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capacity to act on it has been limited. The NDP recognizes that power and roads are binding constraints and it seeks private-public partnerships to accomplish ambitious industrial projects such as steel-smelting plant and fertilizer plants. It recognizes that labor training is a must. However, it has had limited capacity to act on these goals. It is important to enhance the financial and managerial capacity of the government but it is also important to make those limitations less binding on the growth capacity of the country.

By providing property rights on industrial zones and by facilitating competitive private power provision, the government may be able to relax constraints at a minimal financial and managerial cost to itself, using instead the capabilities of the domestic and international private sector. The government could then use its limited resources to provide for the inputs that are hardest to organize through markets, such as rural roads. As additional fiscal resources become available, it will be important to smooth the volatility of government expenditure and increase the quality of expenditure in order to avoid harming Uganda's tradables sector. Sound fiscal rules for guiding expenditures provide a foundation on which Uganda's economy can continue to grow and diversify.

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TECHNICAL APPENDIX I: NATIONAL OIL REVENUE RULE

The rule for oil revenue management is based on two variables: the level of the fund and the amount the government received in the previous year.

$$T_t = \alpha T_{t-1} + \beta F_{t-1}$$

where α and β are fixed parameters less than 1; T and F are the transfers from the fund to the government and the level of the fund, respectively. Notice that over time, the level of the fund will evolve according to the following accounting identity:

$$F_t = (1+r)F_{t-1} + X_t$$

where r is the rate of return on the fund and X is the level of oil tax revenues.

This rule has several advantages. First, it does not depend on any assumption regarding future oil prices. If prices go up during the year, the level of the fund will rise and next year the government will receive a fraction β of this rise. The following year, if oil revenues stay the same, it will receive another fraction $\beta(1+r)$ plus a fraction α of the increased transfers of the previous year. If, instead, revenues were to fall, the government's take would also fall only by a fraction β, the following year by further adjustments the subsequent years. This gives stability to the fund.

One nice feature of this setup is that it avoids having the level of the fund become too large. In fact, this setup not only has good short term stabilizing qualities, but it also has interesting long term properties. To study them, let us consider a situation in which oil revenues reach a permanent steady state level. In this unlikely case, the fund as a share of oil revenues would be determined by the following equation:

$$f_{ss} = \frac{F_{ss}}{X_{ss}} = \frac{(1-\alpha)}{\beta - (1-\alpha)r}$$

Hence, the fund as a share of oil tax revenues would go to a level determined by the parameters of the spending rule and the interest rate. The transfers to be received by the government would be:

$$T_{ss} = X_{ss}\left(\frac{\beta}{\beta - (1-\alpha)r}\right)$$

Notice that $T_{ss} > X_{ss}$ because the government would receive in perpetuity, in addition to the oil revenues, the interest on the level of the fund.

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TECHNICAL APPENDIX II: ECONOMIC COMPLEXITY, DISTANCE, OPPORTUNITY VALUE AND OPPORTUNITY GAIN

Measuring Economic Complexity

If we define Mcp, as a matrix that is 1 if country c produces product p, and 0 otherwise, we can measure diversity and ubiquity simply by summing over the rows or columns of that matrix. Formally, we define:

$$Diversity = k_{c,0} = \sum_p M_{cp} \tag{1}$$

$$Ubiquity = k_{p,0} = \sum_c M_{cp} \tag{2}$$

To generate a more accurate measure of the number of capabilities available in a country, or required by a product, we need to correct the information that diversity and ubiquity carry by using each one to correct the other. For countries, this requires us to calculate the average ubiquity of the products that it exports, the average diversity of the countries that make those products and so forth. For products, this requires us to calculate the average diversity of the countries that make them and the average ubiquity of the other products that these countries make. This can be expressed by the recursion:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} k_{p,N-1} \tag{3}$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_c M_{cp} k_{c,N-1} \tag{4}$$

We then insert (4) into (3) to obtain

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_p M_{cp} \frac{1}{k_{p,0}} \sum_c M_{cp} k_{c,N-2} \tag{5}$$

$$k_{c,N} = \sum_c k_{c,N-2} \sum_p \frac{M_{cp} M_{cp}}{k_{c,0} k_{p,0}} \tag{6}$$

and rewrite this as :

$$k_{c,N} = \sum_c \tilde{M}_{cc} k_{c,N-2} \tag{7}$$

where

$$\tilde{M}_{cc} = \sum_p \frac{M_{cp} M_{cp}}{k_{c,0} k_{p,0}} \tag{8}$$

We note (8) is satisfied when $k_{c,N} = k_{c,N-2} = 1$. This is the eigenvector of $\tilde{M}_{cc}$ which is associated with the largest eigenvalue. Since this eigenvector is a vector of ones, it is not informative. We look, instead, for the eigenvector associated with the second largest

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eigenvalue. This is the eigenvector that captures the largest amount of variance in the system and is our measure of economic complexity. Hence, we define the Economic Complexity Index (ECI) as:

$$ECI = eigenvector\ associated\ with\ the\ second\ largest\ eigenvalue\ of\ \tilde{M}_{cc}$$
(9)

where $\tilde{M}_{cc}$ is given by (8).

Analogously, we define a Product Complexity Index. Because of the symmetry of the problem, this can be done simply by exchanging the index of countries (c) with that for products (p) in the definitions above.

$$PCI = eigenvector\ associated\ with\ the\ second\ largest\ eigenvalue\ of\ \tilde{M}_{pp} \quad (10)$$

Distance, Opportunity Value and Opportunity Gain

Empirically, we find that countries move through the product space by developing goods close to those they currently produce. But countries do not make just one product: they make a certain number of them. Proximity measures the similarity between a pair of products, so we need another measure to quantify the distance between the products that a country makes and each of the products that it does not. We call this measure distance, and defined it as the sum of the proximities connecting a new good p to all the products that country c is not currently exporting. We normalize distance by dividing it by the sum of proximities between all products and product p. In other words, distance is the weighted proportion of products connected to good p that country c is not exporting. The weights are given by proximities. If country c exports most of the goods connected to product p, then the distance will be short, close to 0. But, if country c only exports a small proportion of the products that are related to product p, then the distance will be large (close to 1). Formally we write it as:

$$d_{c,p} = \frac{\sum_p (1 - M_{c,p'}) \phi_{p,p'}}{\sum_{p'} \phi_{p,p'}}$$

Distance gives us an idea of how far each product is given a country's current mix of exports. Yet, it would be useful to have a holistic measure of the opportunities implied by a country's position in the product space. Countries that make products that are relatively complex, given their current level of income, tend to grow faster. Hence, it makes sense to include not only the distance to products, but also their complexity. Some countries may be located near few, poorly connected and relatively simple products, while others may have a rich unexploited neighborhood of highly connected or complex products. This means that countries differ not just in what they make but in what their opportunities are. We can think of this as the value of the option to move into other products. Hence, to quantify the "opportunity value" of a country's unexploited prospects we can add the level of complexity of the products that it is not currently making weighted by how close these products are to the country's current export suite. We can write this mathematically

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as:

$$opportunity\ value_c = \sum_{p'} \frac{\phi_{p,p'}}{\sum_{p'} \phi_{p,p'}} (1 - M_{c,p'})PCI_{p'} - (1 - d_{c,p})PCI_p$$

Where PCI is the Product Complexity Index of product p. The term makes sure that we count only the products that the country is not currently producing. Higher opportunity value implies being in the vicinity of more products and/or of products that are more complex. We can use opportunity value to calculate the potential benefit to a country if it were to move to a particular new product. We call this the "opportunity gain" that country c would obtain from making product p. This is calculated as the change in opportunity value that would come as a consequence of developing product p. Opportunity gain quantifies the contribution of a new product in terms of opening up the doors to more and more complex products. Formally, we can write the opportunity gain as:

$$opportunity\ gain_{c,p} = \sum_{p'} (1 - d_{c,p'})(1 - M_{c,p'})PCI_{p'}$$