INSTITUTIONS AND SECTORAL DIVERSIFICATION IN BOTSWANA

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Abstract

This paper argues that countries with good institutional environments can promote sectoral diversification in an economy by subsidizing firms with positive externalities. The existence of external benefits that can be realized through subsidization is shown with a standard trade model, and an extension of that model shows that good political institutions–specifically, strong constraints on the executive to prevent corruption–will lead to more benefits being realized from subsidies, all other things being equal. Data from Botswana lend support to the theory.

1 Introduction

According to a currently popular school of thought, the quality of a country's institutions–including property rights frameworks, presence and quality of markets, and the form of government, but sometimes also encompassing the "rules of the game" under which economic actors operate–determines its level of long-run economic growth (Acemoglu et al. 2004,

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North 1981). Inefficient institutions can retard economic development (Acemoglu et al. 2006). Meanwhile, other research has identified sectoral diversification as a critical stage of economic development; conversely, sectoral concentration can signify a development failure (Imbs and Wacziarg 2003). This paper uses a theoretical model and empirical analysis to provide some evidence that political institutions, as revealed by government policy, may have a positive impact on sectoral diversification in an economy. To the best of my knowledge, this paper is the first to link these two concepts.

This paper's main contribution is to argue that governments with good institutions will promote sectoral diversification by subsidizing only firms with external benefits, while governments with bad institutions will also subsidize the firms managed by their cronies. These insights are obtained by introducing an extension of a standard trade model. The original model shows that subsidies to firms with external benefits might theoretically increase economic efficiency. In the model, there is an arbitrary number of firms in the same sector wanting to be subsidized by the government so that they can enter the market. Some firms are managed by entrepreneurs and would have external benefits for other firms, which would promote sectoral diversification in the economy. Other firms are managed by cronies of government officials and do not have external benefits. The government may transfer income to either group (depending on whether constraints on the executive are in place), but while transfers to entrepreneurs will contribute to the growth and development of the sector in question, transfers to cronies will not.

How to define "good institutions"? Acemoglu and Johnson (2003) use Polity IV's "constraints on the executive" measure as a proxy for property rights institutions. According to the Polity IV codebook (2009), this measure "refers to the extent of institutionalized constraints on the decisionmaking powers of chief executives, whether individuals or collectivities." An example of a constraint on executive power might be a strong legislature or an independent judiciary. I adopt the same measure, with slightly different underlying logic. Acemoglu and Johnson (2003) are primarily concerned with the lack of executive constraints

being intertwined with expropriation risk. In order to focus on sectoral diversification, I focus on what executives are able to do with government resources, and to what extent they can use those resources to benefit themselves. In this analysis, unconstrained executives can give money to undeserving cronies; constrained executives cannot.

The testable prediction of my model is that improvements in political institutions will be correlated with an increase in sectoral diversification in an economy. I test this prediction with data from Botswana and find that political institutions have a statistically and economically significant positive impact on sectoral diversification (measured using the Herfindahl index) for the time period being analyzed.

I now turn to a brief examination of the existing literature on sectoral diversification and its importance for economic development. According to Imbs and Wacziarg (2003) countries follow a U-shaped path of sectoral concentration. In the beginning stages of development, many countries show high levels of sectoral concentration, often due to reliance on natural resources. Countries then tend to diversify as national income rises, up to a point. In a closed economy, this diversification could be due to changes in individuals' consumption patterns with larger incomes, or it could be due to the "portfolio motive" of investors who want to diversify risk. Imbs and Wacziarg then find that as countries' incomes rise still further, they tend to once again become more concentrated, perhaps due to greater openness to trade or to regional agglomeration economies. In other words, there is a non-monotonic relationship between income and sectoral concentration.

Being at the first peak of the U-shaped path is unhealthy for an economy for a variety of reasons. According to Acemoglu and Zilibotti (1997), "development goes hand in hand with the expansion of markets and better diversification opportunities." An inability to diversify risk in an economy, due to an insufficiently large array of sectors in which one can invest, can lead to slower capital accumulation. Mobarak (2005) finds that sectoral diversification is associated with lower levels of growth volatility, which encourages growth overall. Also, Longhi et al. (2005) find that sectoral diversification is associated with lower levels of

unemployment.

Perhaps most importantly, according to Williamson (2011), the sector in which a country's economy specializes matters for its future chances of economic growth because "traditional agriculture obeys constant returns to scale, and diminishing returns to land, while industry obeys increasing returns to scale." Sectoral diversification can produce positive externalities such as technological spillovers and pecuniary externalities, as Collier and Venables (2007) describe:

> Increasing returns to scale... are often external, meaning that firms in a particular location gain from the presence of other firms in related activities. One set of mechanisms creating these external returns to scale is technological externalities arising as firms learn from other firms, observing and borrowing best-practice technique. These technological spillovers... are typically found to be important, particularly in high-tech industries, and to be spatially concentrated. Notice that the knowledge discovered need not be sophisticated technology–it might simply be discovery of the fact that it is possible to undertake a particular type of business profitably in a particular location...

> In addition to technological externalities there are a number of pecuniary externalities associated with provision of complementary inputs. As a cluster of firms grows so specialist input suppliers develop, markets for intermediate goods become thicker, transport and infrastructure support improves, and workers have a greater incentive to acquire skills.

While the theory of comparative advantage in its simplest form associates sectoral specialization with higher levels of welfare, Redding (1999) develops a *dynamic* theory of comparative advantage which adds depth to the textbook "wine and cloth" story. According to Redding, developing countries have two choices: they can specialize in low-technology areas in which they currently have a comparative advantage, or they can enter high-technology

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sectors in which they do not have such an advantage, with the aim of gaining a comparative advantage in the high-technology sectors (and therefore experiencing productivity growth that might not be possible if they specialized in the low-technology sectors). According to Redding's theory, in a developing country, economic diversification would improve welfare.

Although diversification is economically advantageous, the process is far from automatic. Work by Hidalgo et al. (2007) and Hidalgo and Hausmann (2009) describes the concept of the *product space*, which, in their formulation, is a network of relatedness between products. In short, countries find it easier to develop sectors that are similar to sectors already in place; for example, a country that begins by producing apples will find it easier to start producing pears than to start manufacturing appliances. So, economies tend to make small movements through the product space rather than giant leaps. Given the presence of external benefits in some firms, which may promote diversification, there may be a role for government in internalizing those externalities and thus increasing efficiency.

This paper proceeds as follows. Section 2 introduces the model. Section 3 examines a case study of government intervention in the economy of Botswana with the aim of promoting diversification. Section 4 runs a time-series regression to determine whether, over time, Botswana's government policies aimed at economic development have contributed to sectoral diversification. Section 5 concludes.

2   A simple model

Consider a country with an open economy, which currently has a comparative advantage in commodities but wants to develop a strong manufacturing sector. By assumption, the government has perfect information about which firms will produce spillovers that benefit other firms and thus the development of the sector, but the country's citizens do not.

Because this paper is primarily concerned with institutional effects on sectoral diversification, I will make several simplifying assumptions in the following model. The first assumption

is that the government has perfect information regarding which firms will produce spillovers that benefit other firms and thus the development of the sector. The second assumption is that the government provides a fixed amount of subsidies s to some set of firms, and thus the only choice facing the government is which firms to subsidize. So, the model abstracts away from the possibility of an increase or decrease in subsidies having an effect on sectoral diversification, enabling analysis of the effects that a change only in executive constraints might have. Finally, I assume that the only kind of external benefit present in any firm is an external benefit that makes it easier for other firms to develop. These external benefits, therefore, represent positive potential for sectoral diversification.

I begin with a standard open-economy model of a firm deciding whether to enter an industry, facing a private cost curve that is higher than the social cost curve. Let the cost function of firm i be $C(X_i) = F + \alpha X_i + 0.5\gamma X_i^2$, and let it face a world price of p^* and a subsidy given to this individual firm s_i ($\sum_i s_i = s$). Firm profits are given by the equation $\Pi = (p^* + s_i)X_i - C(X_i)$. Making the appropriate substitutions, the first-order condition of the firm's problem is $d\Pi/dX_i = p^* + s_i - \alpha - \gamma X_i = 0$ (see Appendix A), and thus, in order for the firm to enter the industry, the inequality $(p^* + s_i) > \alpha$ must hold. Also, rearranging,

$$\hat{X}_i = \frac{p^* + s_i - \alpha}{\gamma} \tag{1}$$

Let there be two groups of firms that want subsidies from the government. Some firms are managed by legitimate entrepreneurs (n) while others are managed by cronies of government officials (r). Any firm managed by entrepreneurs that receives a subsidy has external benefits ($e_n > 0$ for all n); firms managed by cronies never have external benefits ($e_r = 0$ for all r).[1] These firms all want subsidies because by assumption, $p^* < \alpha$, that is, the firm cannot survive in the world market on its own. However, a sufficiently large subsidy would enable

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[1]If a firm managed by a friend or relative of a government official does have external benefits, the firm can still act like a firm managed by an entrepreneur and receive a subsidy on its own merits.

either type of firm to survive.

The government's objectives will depend on whether the constraints on the executive are in place. If constraints are in place, the government's objective function is identical to the social welfare function, which takes consumer surplus, producer surplus (firm profits), external benefits, and the government's own revenue into account. Domestic demand is given by $D = a - bp^*$, and so consumer surplus is $V = 0.5(a - bp^*)^2/b$. External benefit is given by $E = e_i X_i$, and government revenue is $G(s_i) = -s_i X_i$. The government's objective function with respect to any given firm is thus:

$$W = V + G(s_i) + E + \Pi(s_i) \tag{2}$$

If constraints on the executive are not in place, the social welfare function and the government's objective function will no longer be the same. The social welfare function is the same as above, but the government's objective function now contains a "kickbacks" term $K = k_i X_i$, where $k_i > 0$ for firms managed by cronies and $k_i = 0$ for firms managed by entrepreneurs. Because the country's citizens do not have perfect information about which firms have external benefits, the executive can claim that they are subsidizing cronies' firms for the good of the economy and receive a kickback secretly, which is safer than funneling money directly from government coffers to themselves. The objective function is now as follows:

$$W = V + G(s_i) + E + K + \Pi(s_i) \tag{3}$$

Assume first that a constrained executive is deciding whether to subsidize a firm managed by entrepreneurs. Making the appropriate substitutions, the first-order condition with respect to the subsidy is $dW/ds_i = (e_i - s_i)/\gamma$ (see Appendix B.1). Therefore, if the subsidy s_i is socially efficient, it will be equal to the external benefit e_i of this firm. It follows that if the firm is managed by cronies and $e_i = 0$, the firm will not receive any subsidy.

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Now assume that an unconstrained executive is deciding whether to subsidize a firm managed by entrepreneurs. Since $e_i > 0$ and $k_i = 0$, the derivation is similar to that of the constrained executive subsidizing entrepreneur firms, and the firm will receive a subsidy e_i. If, however, the firm is managed by cronies, the rent-maximizing subsidy from the executive's point of view will be equal to k_i.

Thus, if there are constraints on the government, they will only give subsidies to entrepreneurs and the external benefits from the subsidies will be given by the equation:

$$e_c = \sum_n e_n \tag{4}$$

If there are no constraints on government officials, they will give some proportion $0 < \phi < 1$ of the subsidy budget to their cronies and the external benefits from the subsidies are as follows:

$$e_{nc} = \phi \sum_r e_r + (1 - \phi) \sum_n e_n \tag{5}$$

$$e_{nc} = (1 - \phi) \sum_n e_n \tag{6}$$

Since $0 < \phi < 1$, it immediately follows that $e_{nc} < e_c$. The implication is that we should expect greater positive external effects from subsidies when the government is constrained regarding which industries it can subsidize. Also, given that all external benefits in this model promote diversification, a positive change in sectoral diversification should result from institutional improvements (increased constraints).

3   Case study: Botswana

The economy of Botswana, which remains heavily reliant on its mining sector, has nevertheless grown at a rate averaging 9% per year between 1967 and 2006 (U.S. Department of State 2010). An analysis by Acemoglu et al. (2003) concluded that "good policies were

chosen in Botswana because good institutions... were in place." These good policies enabled Botswana to use its rich endowment of diamonds to grow at, in some years, the highest rate in the world. Unfortunately, attempts on the part of policymakers to make Botswana's economy less reliant on diamonds have met with very little success. Diamonds presently account for about 70% of Botswana's exports (U.S. Department of State 2010). So, even if Botswana's institutions have been enough to promote growth, they have not promoted *sustainable* growth–the diamonds will eventually run out, after all.

Is Botswana's diamond industry slowing the growth of other sectors of the economy? Several scholars have addressed the interaction between institutions and a country's use of resource endowments, and specifically whether a country suffers from a *resource curse*, in which a resource endowment actually slows down a country's growth (Sachs and Warner 1995). The evidence for the existence of a resource curse is not completely certain, as a truly exogenous measure of resource abundance has yet to be proposed (Torvik 2009). Moreover, the variety in economic performance among resource-rich countries is quite large. Botswana, for example, is often cited as an exception to the "resource curse" rule (see Acemoglu et al. 2003 and Torvik 2009). For example, data from the IMF shows that Botswana has built up a substantial "nest egg" of foreign assets:

Botswana Net Foreign Assets, 2001-2009
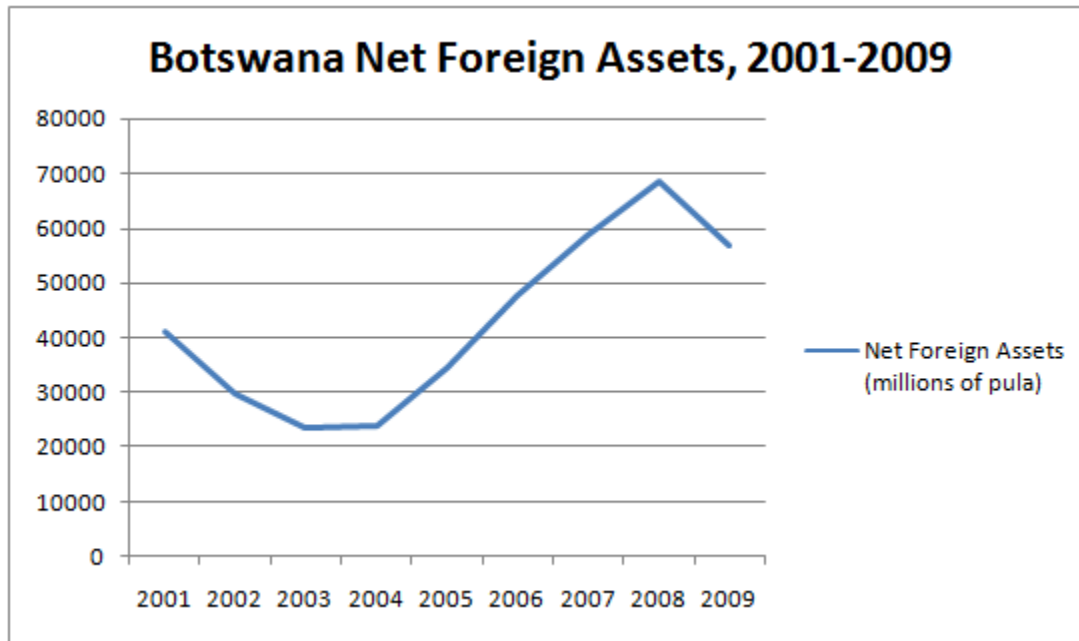
What factors enabled Botswana to use its resource endowment wisely? There are several prevalent theories regarding the determinants of resources' effect on national income: the rate at which a country saves resource income, the type of democratic government, the type of the resources themselves, and whether the country industrialized early or late (Torvik 2009). One generally accepted explanation is known as "Dutch disease," in which increased revenues from natural resources cause a country's currency to appreciate, making exports from other sectors of the economy (such as manufacturing) less competitive. However, Pegg (2010) finds that while some of the symptoms of Dutch disease are present in Botswana (chiefly a lack of sectoral diversification), Dutch disease is not a significant underlying cause.

Moreover, other recent literature suggests that the main determinant of whether a country suffers from a resource curse is institutional quality. Mehlum et al. (2006) find that institutions are decisive in determining whether a country suffers from a resource curse. Similarly, Easterly and Levine (2003) also find that resource endowments influence national income only through institutions, and have no effect otherwise.

With high growth rates, Botswana has avoided a resource curse in the traditional sense–a sign of good institutions. But its failure to diversify suggests that Botswana needs to

change course in some way. The government has a number of possible tools available, with arguments for and against each option.

Botswana's first option is to seek to further improve its institutional environment. Acemoglu and Johnson (2003) find that property rights institutions have a first-order effect on economic growth, among other things. It is possible that better institutions might thus encourage the development of new industries and thus diversification. As previously mentioned, Acemoglu et al. (2003) document a history of relatively good institutions in Botswana, but other scholars (e.g. Good and Hughes 2002) argue that Botswana's institutions could still use improvement. If Acemoglu is correct that institutions are a major determinant of economic growth, Botswana should certainly focus on optimizing its institutions. However, Acemoglu's views have received criticism from Glaeser et al. (2004), who argue that typical methods of measuring institutional quality are flawed to the point of being unusable, and that in actuality, institutions are not as important to growth as human capital. In turn, Acemoglu et al. (2005) call Glaeser et al.'s regressions into question.

Alternatively, Botswana could pursue industrial policy, or government subsidization of certain favored sectors of the economy. Hausmann and Rodrik (2003) say that such subsidization promotes a process of cost discovery, during which entrepreneurs determine what a country is actually good at producing. However, Krueger (1990) argues that subsidies are doomed to fail in practice because governments do not have better information than the private sector regarding which sectors should be subsidized, and even if they had this information, bureaucracies do not have the incentives or the ability to implement a subsidy properly. In fact, Botswana has attempted industrial policy in the past.

In 1993, with considerable support from the government of Botswana, Hyundai opened a plant in the business-friendly environment of Botswana's capital, Gaborone. The Botswana Development Corporation, a government agency, invested 85.6 million pula in the plant. Hyundai licensed the Motor Company of Botswana to operate the plant, as well as another firm, Hyundai Motor Distributors. After six years of rapidly expanding production, during

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which Volvo also began producing in Gaborone, automobile production represented "considerable investment in plant, equipment, jobs, labor skills, and diversification." Many other factories had already located in Gaborone or were making plans to do so, and the balance of trade ratio between Botswana and South Africa had been narrowed from 1:25 to 1:6.

The Motor Company of Botswana was owned by Billy Rautenbach, a prominent Zimbabwean entrepreneur who owned 150 companies in 13 countries. Good and Hughes (2002) provide some evidence that Rautenbach was highly corrupt. With South Africa's automobile manufacturers and workers' unions strongly opposed to automobile production in Botswana, the South African government launched a massive investigation against Rautenbach. As a result, the Botswana Development Corporation decided to have the Motor Company of Botswana liquidated in January 2000, at which point the Hyundai plant moved to South Africa and Volvo also left the country. The Botswana Development Corporation asked the government for funds to bid on the Hyundai plant and thus keep it within Botswana, but the government refused.

Why did the Batswana government refuse to buy the plant? After all, it sold at auction for the equivalent of USD 7.2 million. The government could easily have afforded to match or exceed that price. Unfortunately, news and commentary from Botswana during the period 1999-2000 are not readily available. Therefore, it may be useful to form a few working hypotheses about the government's reasoning, operating under different assumptions and theoretical constraints.

First, let us assume that policymakers had perfect information about the Batswana economy and the automobile industry in particular. If executives were operating under sufficient constraints such that their actions were aligned with the interests of the Batswana people, then their actions would mean that they had determined that no external benefits would be internalized by continuing to subsidize the automobile industry.

If, on the other hand, executives were relatively unconstrained and could make decisions that were best for themselves, they might have wanted to bring a swift end to a saga that was

surely a national embarrassment, or to use government funds to enrich themselves. There is some anecdotal evidence for this possibility. For instance, around the time of the MCB's collapse, the government awarded millions of dollars to the textile firm Haltek, which–perhaps by complete coincidence–then bought a struggling company owned by the treasurer of the Botswana Democratic Party, which has been in power in Botswana since 1965 (Good and Hughes 2002).

If we relax the assumption of perfect information, but keep the assumption that the government was sufficiently constrained, they may not have known whether an externality existed. They may have taken the car industry's collapse as evidence that an externality did not exist, when in fact the industry thrived for several years and might have continued to do so under better and more prudent management. They may have chosen to avoid the risk of further investment in a venture that had "proved" to be unsuccessful, and rely on diamond revenue for government revenue and for economic growth more generally.

Finally, we turn to the scenario under which the government does not have perfect information and is not sufficiently constrained. In this scenario, government officials chose to enrich themselves (just as they did under the unconstrained / perfect-information scenario above), and could more fully justify their decision since they were unable to take the "long view" in which a thriving automobile industry would benefit all of Botswana and thus make them better off as well.

Which hypothesis is correct? The answer matters because it can help determine whether the failure of the automobile industry in Botswana was a special case, unlikely to happen again, or whether the failures that occurred are endemic to industrial policy in general. While the knowledge and intentions of the government cannot be observed directly, the results of their actions can. For that, we will now turn to the data.

4 Empirical testing

4.1 Data

Sectoral concentration is most commonly measured by the Herfindahl index (*lnherf*), which is the sum of the squares of each sector's share of the economy. Squaring the shares gives more weight to larger sectors. For instance, a ten-sector economy in which all sectors are the same size would have a Herfindahl index of $10(0.1^2) = 0.1$. If one sector produced 55% of economic output and the other nine sectors produced 5% each, the Herfindahl index would be $0.55^2 + 9(0.05^2) = 0.325$. Thus, the more concentrated an economy is, the larger its Herfindahl index will be (Kelly, 1981). Calculating Herfindahl indices for the economy of Botswana for the years 1989-2009 using sectoral data from the Bank of Botswana yielded values that ranged from 0.17 to 0.27. Although the exact values of the Herfindahl index would depend on the degree to which one decomposed the economy into a greater or lesser number of sectors, measuring the *changes* in the Herfindahl index can show whether Botswana's public policy has made the economy more or less diversified.

A table showing the shares of various sectors in the economy of Botswana for selected years in the period 1989-2009 is below.

	1989	1994	1999	2004	2009
Agriculture	0.049	0.041	0.028	0.020	0.031
Mining	**0.463**	**0.354**	**0.353**	**0.393**	**0.274**
Manufacturing	0.050	0.053	0.052	0.039	0.042
Water and electricity	0.025	0.023	0.023	0.027	0.030
Construction	0.074	0.066	0.060	0.051	0.055
Trade, hotels, and restaurants	0.073	0.101	0.115	0.113	0.143
Transport, post, communication	0.028	0.040	0.039	0.035	0.051
Banks, insurance, and business	0.074	0.115	0.115	0.108	0.130
General government	0.127	0.161	0.173	0.175	0.194
Social and personal services	0.037	0.046	0.042	0.039	0.048

The resulting values of the Herfindahl index for the entire period are shown on the following graph:

Botswana Herfindahl index, 1989-2009
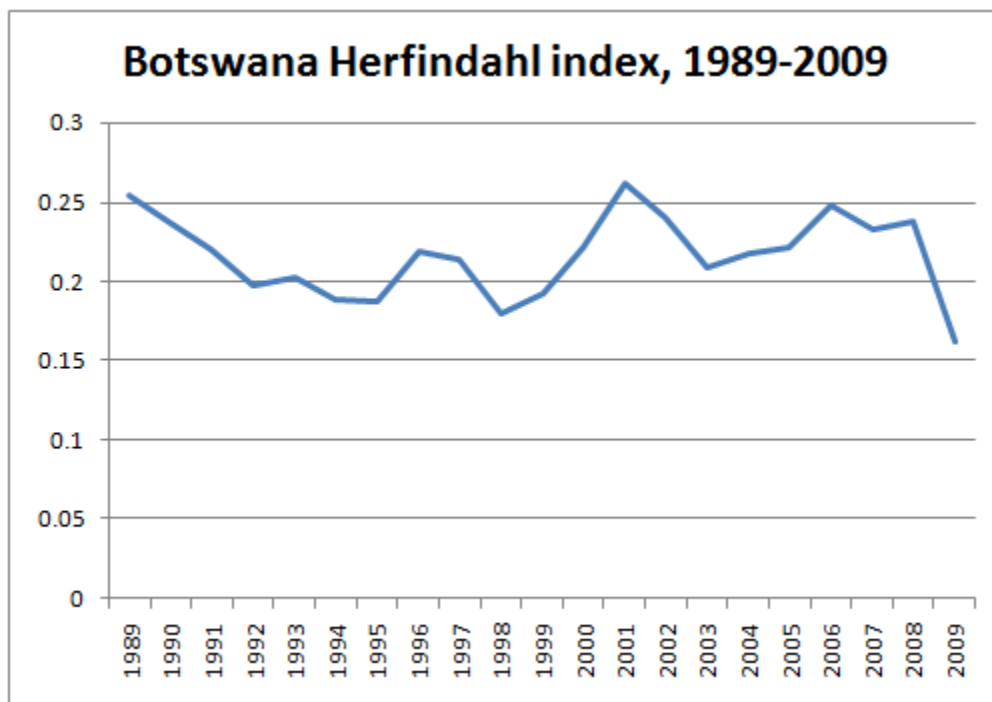
What are the determinants of sectoral diversification? Public policy in several dimensions could conceivably be related. Trade openness (*lnopen*) is measured using the standard measure of exports plus imports as a percentage of GDP. Industrial policy (*lnrbdcva*), or government subsidies to different industries, is measured by the Botswana Development Corporation's value added to the economy, as reported by the BDC itself. Finally, quality of government institutions is measured by the XCONST indicator from the Polity IV index (*lnpolity*), which specifically measures constraints on the executive branch of the government. If these constraints are in place, then policymakers should not be able to enrich themselves at the expense of the people of Botswana; in other words, policies aimed at diversification (such as industrial policy or trade policy) should be, in fact, aligned with the nation's economic interests.

Two control variables, also, are included to avoid omitted variable bias. The exchange rate (*lnexchsdr*) between the Botswana pula and the International Monetary Fund's standard basket of currencies, which I obtained as a time series from the IMF, could affect the balance of sectoral output. In a second version of the regression, I include not only the exchange rate

but also total factor productivity; if productivity increases mainly took place in the mining sector but not elsewhere (or vice versa), it could affect the balance of sectoral output as well.

I took the logarithm of all variables and applied the first difference operator to each. The final regressions are therefore as follows:

$$\Delta lnherf_t = \beta_1\Delta lnopen_{t-1} + \beta_2\Delta lnrbdcva_{t-1} + \beta_3\Delta lnpolity_{t-1} + \beta_4\Delta lnexchsdr_t + \epsilon_1 \quad (7)$$

$$\Delta lnherf_t = \beta_5\Delta lnopen_{t-1} + \beta_6\Delta lnrbdcva_{t-1} + \beta_7\Delta lnpolity_{t-1} + \beta_8\Delta lnexchsdr_t \quad\quad (8)$$

$$+ \beta_9 tfp + \epsilon_2 \quad\quad\quad (9)$$

The results of this regression, using the years 1996-2008, are shown in the table below. Although I could not obtain a longer time series for certain key variables, the regression nevertheless had an adjusted r-squared value of approximately 0.62.

	(1)	(2)
	D.lnherf	D.lnherf
LD.lnopen	-0.270	-0.210
	(-1.08)	(-1.04)
LD.lnrbdcva	0.0341	0.0460
	(0.91)	(1.51)
LD.lnpolity	-1.548**	-2.178***
	(-2.90)	(-4.33)
D.lnexchsdr	0.634**	0.601***
	(3.30)	(3.90)
D.lntfp		1.408*
		(2.35)
_cons	-0.0142	-0.00931
	(-0.57)	(-0.46)
N	13	13

t statistics in parentheses

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

Openness to trade (*lnopen*) is not statistically significant in either version of this regression. Furthermore, the sign is negative in both cases. One might expect it to be significant and positive (which would mean that more openness is associated with greater sectoral concentration), as more openness might push Botswana to specialize in the industry in which it currently had a comparative advantage (mining). However, this is not the case in the data,

probably because in the time period being analyzed, openness remains fairly constant.

Likewise, value added to the economy by Botswana's industrial policy (*lnrbdcva*) is statistically insignificant in both regressions, and the coefficient, while positive, is small. So, even industrial policy that is productive in absolute terms is not correlated with diversification. This result suggests that government officials either are not correctly identifying industries with external benefits, or are directing industrial policy according to some goal other than sectoral diversification. The latter possibility is inconsistent with the stated goals of the government of Botswana (Conteh 2008).

On the other hand, the exchange rate (*lnexchsdr*) between the pula and the IMF's basket of currencies, which was included as a control variable, is statistically significant at the 5% level (without productivity included) or at the 1% level (with productivity included), with a positive sign. This could be expected because if external demand for diamonds increases, the value of Botswana's currency will appreciate, and the mining sector will expand as well. So, it makes sense for appreciation of Botswana's currency and sectoral concentration to be positively correlated.

In the second regression, productivity (*lntfp*) is positive and weakly significant (at the 10% level). This indicates that increases in productivity are weakly correlated with increases in sectoral concentration, possibly meaning that increases in productivity in Botswana during the time period being analyzed took place in the mining sector more than other sectors.

Most notably, improvements in Botswana's institutions, as measured by the Polity IV index (*lnpolity*), appear to have had a negative effect on sectoral concentration–that is, a positive effect on diversification. The coefficient is both negative and statistically significant at the 5% level (without productivity included) or at the 1% level (with productivity included). This finding supports Acemoglu et al.'s hypothesis that institutions are an important ingredient in the functioning of an economy–not just for growth, but for sectoral diversification as well.

5 Conclusion

I introduced a model in which, even though the government had perfect information regarding firms' external benefits, they failed to respond in a socially optimal manner if the necessary constraints on the executive were not present. Good political institutions can mitigate this issue. As we saw in the regression analysis, institutional improvements had a statistically and economically significant impact on sectoral diversification in Botswana, which lends support to the idea that governments with better institutions can do a better job of internalizing external benefits. Further research could construct a similar model incorporating uncertainty about the presence of external benefits in certain firms, or could perform a similar empirical analysis in other countries.

In an ideal world, governments would be able to correctly identify external benefits in industries that possess them, and accordingly make adjustments to compensate for those market failures. However, in practice, one might expect that externalities would be difficult to identify, and that even if they could be identified, the challenges of bureaucracy and perverse incentives would make it difficult for governments to make the proper adjustments to the market. The data from Botswana lend support to these expectations. In terms of promoting diversification, industrial policy per se seems to be unimportant once institutions are accounted for. Therefore, Botswana should focus on improving its institutional environment if it wishes to develop the non-mining sectors of its economy.

This paper does not suggest that Botswana's institutions have not served it well so far. However, even good institutions should be subject to critical scrutiny, especially as major events–for example, the impending end of a long-standing resource boom–change the very foundations of a nation's economy. In this way, countries can maximize their chances of future economic growth.

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A Appendix: the firm's problem

A firm's profit function is $\Pi = (p^* + s_i)X_i - C(X_i)$.

Substituting,

$$\Pi = (p^* + s_i)X_i - (F + \alpha X_i + 0.5\gamma X_i^2) \tag{10}$$

$$d\Pi/dX = p^* + s_i - \alpha - \gamma X_i \tag{11}$$

$$\tag{12}$$

$$0 = p^* + s_i - \alpha - \gamma \hat{X}_i \tag{13}$$

$$\gamma \hat{X}_i = p^* + s_i - \alpha \tag{14}$$

$$\hat{X}_i = \frac{p^* + s_i - \alpha}{\gamma} \tag{15}$$

It follows that for $\hat{X}_i > 0$, it must be the case that $p^* + s_i > \alpha$.

B Appendix: the optimal subsidy

B.1 With constraints on the executive

The social welfare function is $W = V + G(s_i) + E + \Pi(s_i)$.

First assume that the firm in question is managed by entrepreneurs and $e > 0$. Substituting,

$$W = \frac{1}{2b}(a - bp^*)^2 - s_i X_i + e_i X_i + (p^* + s_i)X_i - (F + \alpha X_i + 0.5\gamma X_i^2) \tag{16}$$

$$W = \frac{1}{2b}(a - bp^*)^2 - s_i \frac{p^* + s_i - \alpha}{\gamma} + e_i \frac{p^* + s_i - \alpha}{\gamma} + (p^* + s_i)\frac{p^* + s_i - \alpha}{\gamma} \tag{17}$$

$$- \left(F + \alpha\frac{p^* + s_i - \alpha}{\gamma} + 0.5\gamma\left(\frac{p^* + s_i - \alpha}{\gamma}\right)^2\right) \tag{18}$$

$$dW/ds_f = -\frac{p^* + s_i - \alpha}{\gamma} - \frac{s_i}{\gamma} + \frac{e_i}{\gamma} + \frac{p^* + s_i - \alpha}{\gamma} + \frac{p^* + s_i}{\gamma} - \frac{\alpha}{\gamma} - \frac{p^* + s_i - \alpha}{\gamma} \qquad (19)$$

$$0 = \frac{e_i - \hat{s}_i}{\gamma} \qquad (20)$$

$$e_i = \hat{s}_i \qquad (21)$$

If the firm is managed by cronies, a similar derivation with $e_i = 0$ shows that the firm will receive no subsidy from the government.

B.2   Without constraints on the executive

The government's objective function is now $W = V + G(s_i) + E + K + \Pi(s_i)$.

For firms managed by entrepreneurs, since $K = 0$, the derivation of the first-order condition is identical to the derivation above. For firms managed by cronies, $e_i = 0$, but $k_i > 0$ and the derivation of the first-order condition is as follows:

$$W = \frac{1}{2b}(a - bp^*)^2 - s_i X_i + e_i X_i + k_i X_i + (p^* + s_i)X_i - (F + \alpha X_i + 0.5\gamma X_i^2) \qquad (22)$$

$$W = \frac{1}{2b}(a - bp^*)^2 - s_i \frac{p^* + s_i - \alpha}{\gamma} + k_i \frac{p^* + s_i - \alpha}{\gamma} + (p^* + s_i)\frac{p^* + s_i - \alpha}{\gamma} \qquad (23)$$

$$- \left(F + \alpha\frac{p^* + s_i - \alpha}{\gamma} + 0.5\gamma\left(\frac{p^* + s_i - \alpha}{\gamma}\right)^2\right) \qquad (24)$$

$$dW/ds_f = -\frac{p^* + s_i - \alpha}{\gamma} - \frac{s_i}{\gamma} + \frac{k_i}{\gamma} + \frac{p^* + s_i - \alpha}{\gamma} + \frac{p^* + s_i}{\gamma} - \frac{\alpha}{\gamma} - \frac{p^* + s_i - \alpha}{\gamma} \qquad (25)$$

$$0 = \frac{k_i - \hat{s}_i}{\gamma} \qquad (26)$$

$$k_i = \hat{s}_i \qquad (27)$$