



ESCAPING THE DUTCH DISEASE: THE ROLE OF PUBLIC INVESTMENT IN NIGER

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ABSTRACT

This paper describes the use of a recursive dynamic computable general equilibrium model to the analysis of two investment strategies of natural resources revenue in Niger. Potential impact of education and infrastructure investment on some selected macroeconomic and welfare variables are simulated. The results show that the economy performs better with a low risk of Dutch Disease when the windfall is invested either in education or in infrastructure. Superior results are obtained when the windfall is simultaneously invested in education and infrastructure, which implies a complementary effect between the two investment strategies.

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Contribution/ Originality

This study contributes in the existing literature by using a dynamic computable general equilibrium to investigate the role of two public investments strategies in lowering the risk of Dutch Disease in Niger.

1. INTRODUCTION

Niger has been consistently ranked at bottom in terms of human development index¹ by the United Nations Human Development Program. The country lacks adequate infrastructure like roads, bridges, and dams. The literacy rate in Niger is the lowest in the world. Since its independence, Niger has been struggling to become energy independent. Indeed, more than 70% of the electricity used in Niger is imported from Nigeria. The government has a project since the

¹ In 2014 Niger is ranked 187 out of 187 countries.

1970's to build a hydroelectric dam, which is known as the Kandadji Dam. The Dam was supposed to make Niger energy independent and reduce food insecurity which is chronic due to recurrent drought. However, after four decades, this project is yet to materialize.

The paradox is that Niger is a major exporter of Uranium and has recently started producing oil. The abundance of natural resources in Niger should have spurred economic growth; but instead have done little to affect long run economic growth. This phenomenon is known as the Dutch disease and is not unique to Niger itself. The literature on Dutch disease (Auty, 2001; Gylfason, 2007) emphasizes that an inflow of a natural resources windfall in a country causes an appreciation of real exchange rate, thereby reducing the country's competitiveness. In addition, Papyrakis and Gerlagh (2007) found that even in a relatively homogeneous sample, resource abundance can have a significant negative impact on economic growth by affecting various economic fundamentals such as investment levels, schooling rates, and openness. Gylfason (2007) distinguished five channels through which natural resources can negatively affect an economy: corruption, neglect of education, reduction of private and public investment, crowding out of financial capital, and reduced competitiveness. The main objective of this paper is to show that Niger can escape the Dutch disease if the windfall from natural resources export is spent strategically. To this end, a recursive dynamic computable general equilibrium model is used to analyze the economy wide impact of investing natural resources revenue on education and infrastructure. These two investment strategies are the core of Niger's poverty reduction strategies².

The rest of the paper is divided as follows. The next section goes over the theoretical model and the data used to calibrate the model. In section III, the macroeconomic impact of each simulation is presented and analyzed. The last section concludes the study with some policy recommendations.

2. MODEL

The model used to formalize the theoretical relationship is an intertemporal dynamic Computable General Equilibrium model³. It satisfies a system of constraints: supply-demand equilibrium conditions and the macroeconomic closure rule. In a competitive market, prices adjust to clear the factor and product markets. That is, domestic prices adjust to bring about equilibrium in the market for each good. The average skilled and unskilled wage rates adjust to clear the skilled and unskilled labor market. Niger has a fixed exchange rate which means foreign capital inflow will have to adjust to bring the balance of payments in equilibrium. Finally, a neoclassical closure is adopted implying aggregate saving is equal to total investment.

To capture the effect of public investment in education and infrastructure, the initial model has been modified to include new equations. These equations serve as a transmission channel through which each investment policy affects the economy.

² www.imf.org/external/pubs/ft/scr/2013/cr13106.pdf

³ The detail description of the model used in this study can be found in Soumaila (2014).

2.1. Value Added

As in Levy (2007), investment in infrastructure is assumed to raise the productivity of both labour and capital.

$$VA_{it} = TFPR * A_{it} LUS_{it}^{\alpha_{Li}} LS_{it}^{\alpha_{Ls}} K_{it}^{1-\alpha_{Li}-\alpha_{Ls}} \quad (1)$$

$$TFPR = \lambda_{TFPR} * (GIFINV * GrowthIF)^{\mu} \quad (2)$$

Equation 1 shows the modified version of the value-added function. The new function now incorporates a new concept termed total factor productivity ($TFPR$). The $TFPR$ can be interpreted as a shift parameter that raises the productivity of both capital and labour. Equation 2 shows that $TFPR$ is a function of government infrastructure investment ($GIFINV$) and growth in infrastructure investment ($Growth$). The parameter (μ) is the elasticity of public capital with respect to national product. Nachega and Thomson (2006) studied the determinants of the total factor productivity in Niger from 1963 to 2000. They found that the growth of public capital had a significant positive impact on the growth rate of real GDP. They estimate (μ) to be on average 0.4. However, Dessus and Rémy (1999), using panel data from developing countries studies, found the value of (μ) to range from 0.2 to 0.7. In this study μ is set at 0.2 to account for the very low level of infrastructure investment in Niger. ($Growth$) represents the growth of public infrastructure investment. For Simulation I, the parameter λ_{TFPR} is calibrated such that the ($TFPR$) is equal to 1.

2.2. Labour and Capital Dynamic

The labour force in Niger (LF) grows at the same rate as the population (n) as given in equation 3.

$$LF_{i,t+1} = (1+n)LF_{it} \quad (3)$$

$$LS_{i,t+1} = LS_{it} + Educ * ShareED_i \quad (4)$$

$$Educ = eff. * Enr \quad (5)$$

$$Eff = \lambda_{HC} * (GHCINV * GrowthHC)^{\mu_{ed}} \quad (6)$$

$$LUS_{i,t+1} = LF_{i,t+1} - LS_{i,t+1} \quad (7)$$

The sectoral supply of skilled labour ($LS_{i,t+1}$) in equation 4 evolves over time based on incoming educated labour⁴ ($educ$) times the sectoral share of skilled labour ($ShareE_i$). Investment in education increases the supply of educated labour relative to the supply of unskilled labour by increasing the number of new incoming students with at least 10 years of schooling (equation 5). Moreover, investment in education is assumed to increase the productivity of skilled workers. Equation 6 shows the efficiency factor (Eff), which is influenced by government

⁴“Educated labour force” is defined as people in the labour force with at least 10 years of schooling.

investment in human capital ($GHCIN$). The efficiency factor is set to 0.447, which is the proportion of students coming into the labour force in 2004 with at least 10 years of schooling. μ_{ed} is the elasticity of human capital with respect to national product and is set to 0.2 based on the estimate of Nachega and Thomson (2006). The parameter λ_{HC} is calibrated such that the (Eff) is equal to 0.447 for the base run. The next period supply of unskilled labour in equation 7 is determined as being the difference between the labour force and skilled labour.

$$K_{i,t+1} = K_{0,it} + dK_{it} \quad (8)$$

The sectoral capital stock for the following period ($K_{i,t+1}$) in equation 8 is equal to the initial capital stock (Zo_{it}) of sector i at time t plus the sectoral capital accumulation (dK_{it}),.

2.3. Data

The model is calibrated using a 2004 social accounting matrix (SAM) obtained from Niger's National Institute of Statistics. The Niger SAM consists of nine activities and commodities which are: rural, mining, manufacturing, utilities, construction, commerce, transport and telecommunication, financial services, and other services. There are five household groups differentiated by the type of activities.

3. SIMULATIONS AND RESULTS

3.1. Simulations

The baseline scenario (simulation I) consists of using uranium windfall⁵ that the government of Niger received in 2004 for consumption and saving. Specifically, it is assumed that the government uses 1/3 of the revenue and transfers 2/3 to household. The results of Simulation I show that the impact of a natural resource windfall on Niger's economy is mixed. First, the windfall improves the economy's performance. Real GDP increases and the household welfare improves. However, the signs of Dutch disease show up as the CPI increases (Soumaila, 2014).

In simulation II the entire natural resource windfall is invested in education. Simulation III assumes that the natural resource windfall is invested in infrastructure. Finally, in Simulation IV, the government is assumed to spend half of the windfall on infrastructure and the other half on education.

3.2. Results

Table 1 shows that the three investment strategies are growth promoting. On average, over the period of 2005 to 2015, the real GDP increases substantially in all three simulations. However, on average, the real GDP is 58.98% higher in Simulation IV compared with Simulation I. As expected, the mixed policy yields the highest level of GDP compared with the first three simulations reflecting the rising productivity of both capital and labour due to the new

⁵ In 2004 the government of Niger received 78.54 billion of CFA from exporting uranium.

infrastructure and more educated labour force. This result supports the hypothesis that there is a complementary effect between education and infrastructure.

Although the CPI is higher in Simulation IV compared with Simulations II and III it is still below the level observed in Simulation I. This result is interesting because it shows that simultaneous investment in education and infrastructure yields the highest level of GDP possible with relatively modest inflation and therefore lowers the risk of Dutch disease.

Table-1. Twelve years average change (in comparison with simulation I) of macroeconomic variables

	Simulation II	Simulation III	Simulation IV
Real GDP	21.13%	36.80%	58.98%
CPI	-3.56%	-5.22%	-0.21%
Nominal unskilled wages	-1.13%	23.83%	41.10%
Nominal skilled wages	58.14%	65.74%	195.56%
Capital income	-0.64%	26.63%	35.26%
Government income	8.46%	18.62%	57.99%
Private saving	40.80%	45.41%	146.05%
Public saving	63.61%	146.21%	292.54%
Total saving	32.91%	41.85%	129.65%
Total investment	34.62%	60.80%	147.38%
Export	13.53%	28.67%	71.99%
Import	11.82%	26.84%	68.27%
Total sectoral production	12.24%	31.66%	75.03%
Growth of GDP	9.12%	13.62%	18.50%
Gini coefficient	6.27%	6.08%	7.88%

Table 2 shows the welfare impact of different investment strategies using equivalent variation as a measure. Overall, the welfare of all the representative households improves regardless of which investment strategy is adopted. Moreover, skilled households experience a greater improvement in welfare, primarily because of the increase in skilled wages mentioned previously. However, skilled household welfare decreases in Simulation III relative to Simulation I.

Table-2. Welfare Impact of Windfall: 12 Years Average of Equivalent Variation

	Agricultural Household	Skilled Household	Unskilled Household	Informal Household	Capitalist Household
Simulation I	45.01	217.76	33.49	48.47	10.93
Simulation II	35.74	226.47	27.66	40.12	9.79
Simulation III	58.96	189.28	46.02	66.39	15.24
Simulation IV	66.62	298.62	52.41	76.71	17.53

Agricultural households, unskilled households, informal households, and capitalist households see an improvement in their welfare in Simulations III and IV compared with Simulation I. But they experience a relative decrease in welfare when the natural resource windfall is invested in education. This decrease is due to the shrinkage of unskilled labour income, the major source of income for these households, in Simulation II compared with Simulation I.

Policy trade-offs are quantified with respect to growth and Gini coefficient. Table 13 shows the average growth rate over twelve years of real GDP and the Gini coefficient under Simulations II through IV. The highest growth rate is obtained in Simulation IV, whereas the lowest growth rate is obtained in Simulation III. However the higher growth rate comes with higher income inequality because Simulation IV also has the highest Gini coefficient. This result implies that if policy makers are more concerned about growth than inequality, Simulation IV is the best policy option. The lowest Gini coefficient is obtained in Simulation III.

Table-3. Average Growth Rate of Real GDP and Gini coefficient

	Simulation II	Simulation III	Simulation IV
Growth of GDP	9.12%	13.62%	18.50%
Gini coefficient	6.27%	6.08%	7.88%

4. CONCLUSION AND POLICY IMPLICATION

This study focuses on experimenting with three investment strategies which the government of Niger may adopt in order to avoid the risk of Dutch disease in the economy. These three investment strategies are investment in education (Simulation II), investment in infrastructure (Simulation III), and simultaneous investment in education and infrastructure (Simulation IV). First, in the case of Simulation II, investment in education creates more skilled labour in the economy, increasing the level of real GDP relative to Simulation I. Moreover, the increase in CPI observed in Simulation I is reversed in Simulation II, implying that education investment reduces the risk of Dutch disease. Of the five household groups, only skilled household income increases in Simulation II relative to Simulation I reflecting the bias of education investment. The Gini coefficient also increases as a result of this uneven income distribution.

Secondly, investment in infrastructure appears to have many positive effects on the economy. It increases real GDP and lowers, on average, the CPI. The remarkable result of the simulation is that investment in infrastructure improves the welfare of all household groups without raising the Gini coefficient index.

Finally, Simulation IV considers a situation where the government invests the windfall in both education and infrastructure. The results are superior to those obtained in the previous simulations. Real GDP is higher, household welfare increases substantially, and the CPI is relatively low compared with Simulation I. However income inequality increases slightly in comparison with the other simulations.

Given Niger's low level of infrastructure and schooling rate, the government is better to avoid wasteful spending and is better to spend the natural resources windfall in education, roads and other rural infrastructures.

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