Factors Affecting Markets, Economic Growth and Economic Development: Three Essays in Applied Economics

By

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Abstract

This dissertation consists of three essays. The topics of the essays are not necessary related, and each essay constitutes a chapter in this dissertation. The first chapter presents farm and retail models developed to determine the nexus between market factors and marketing margin in the U.S beef industry. Elasticity values obtained through error correction models (ECMs) were used in the equilibrium displacement modeling approach (EDM) to permit the full display of the paths through which shock in markets, in particular retail concentration affect the margin. Findings show that exogenous shifts that affect supply and demand of beef at retail and farm level, cause changes in quantities, prices and farm-retail margin. Consumer income, the farm production technology, oil price and retail concentration ratio, all increase the farm-retail marketing margin and this is due to retail price adjusting to change in farm price.

Chapter 2 uses panel data covering 128 Alabama public school systems for the time period 2002–2011 to determine the impacts of academic performances and socio-economic factors on Alabama public school enrollment. Findings suggest that increase in test scores in reading, math and language, all increase school enrollment. However, the larger increase is observed with the increase in test scores in math. A 10 percent increase in test scores in reading, math and language raises school enrollment by 0.28 percent 1.23 percent and 0.65 percent respectively, suggesting that higher academic performance in math has a greater impact on parents' decision to enroll their children in specific schools. In addition, the results indicate increase in non-instructional expenditures, and increase in the number of full time teachers

produce a positive impact on enrollment. School enrollment increases by 0.12 percent and 1.01 percent when non-instructional expenditures and the number of full time teachers increase by 10 percent, reinforcing the very fundamental notion which suggests “money matters” in education output. On the opposite side, the findings indicate that growth in family income leads to a decrease in public school enrollment, and may indicate that pupils emigrate from public schools to private schools when the financial conditions of their family improve.

Chapter 3 provides empirical evidences of factors affecting corruption and economic growth, with particular attention given to the impacts of the United Nations convention against-corruption (UNCAC) of the level of corruption and GDP per capita in Sub-Saharan African (SSA). Simultaneous equation model with panel data covering 20 countries in Sub-Saharan Africa for the period 1999-2013 were used. Findings indicate that the implementation of the policy has decreased the level of corruption and increased per capita GDP only in Middle Africa. Corruption decreases by 0.65 percent while GDP per capita increases by 0.67 percent after implementation of the policy. In the other parts of the SSA, the impacts are mostly nil. This suggests that UNCAC failed in its fundamental goal, which is to eradicate corruption and to promote economic growth throughout the continent. The empirical results also provide two key findings in that factors that decrease corruption increase economic growth while factors that increase economic growth decrease the level of corruption.

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Chapter 1: Analyzing the Farm-Retail Marketing Margin of U.S. Beef: An Equilibrium Displacement Modeling Approach

1.1 Introduction

Farm production costs have continued to increase in the past years (Anderson et al., 2008). However, the marketing margins of agricultural products such as beef continue to widening and remain controversial. In fact, many farmers believe that this price differential is a result of retail marketing pricing behavior, or the four firm concentration ratio, considered as market power. Gordon and Hazledine (1996) suggest that this form of the market power is likely to manifest in larger marketing margins than would otherwise be the case.

Marketing margin is an equilibrium that is a function of the difference between equilibrium retail and farm prices (Wohlgenant, 2001), or between export and farm prices (Carambas, 2005); and it gives information about a particular industry (Tomek and Robinson, 1990). Marketing margins are the result of demand and supply factors, marketing costs, and the degree of marketing channel competition (Marsh and Brester, 2004). Thus, the margins reflect aggregate processing and retailing firm behavior which influence the level and variability of farm prices (Marsh and Brester, 2004; Gardner, 1975; Wohlgenant, 1987). In addition, retail prices are more sensible to increases in farm price than it decreases (Kinnucan and Forker, 1987). This price adjustment, if not well operate would certainly contribute to the price differential.

The purpose of this study is to determine the analytical expressions that will help explain the channels through which exogenous shifts in particular the retail concentration ratio impacts prices and the marketing margin of beef. In fact, the determination and setting of prices along the marketing chain is not well understood using partial equilibrium analysis system since temporal price increases and decreases are asymmetrical. Hence, in this study we will attempt to show how farm and retail price are affected within a general equilibrium system.

Results of the study by Marsh and Brester (2004) suggest that variables such as technology and the market concentration ratio have had a positive impact on wholesale-retail beef margin. However, at the farm-retail level analysis, Kinnucan and Tadjion (2014) shows that market concentration does not affect the margin significantly. The econometric approaches used in these cited studies do not permit the full display of the paths through which a shock in market concentration affects the margin as it should have been if the models provide analytical solutions.

Indeed, study by Gardner (1975) allows the explanation of equilibriums observed in the retail food, farm output and marketing sectors. The main focus of Gardner's model is to show how the margin responds to shifts in retail demand, farm supply, or the demand or supply of marketing inputs.

Compared to the previously cited authors, Gardner's model does not incorporate the market concentration ratio as an exogenous perturbation that could affect the margin. Thus, the analytical expressions of the farm and retail prices as well as the margin for a given shock in the market concentration ratio were not determined. Consequently, how retail concentration induces changes in market prices and the margin still remains unanswered. Hence, provides a ground for this study.

The study will start by revisiting previous models, before presenting the model of the study, the comparative static analysis and simulations, the results and concluding remarks.

1.2 Revisiting Previous Models

1.2.1 *Marsh and Brester's (2004) model*

The behavior model specification developed by Marsh and Brester to estimate the determinants of wholesale-retail marketing margin of beef and pork, employed eight structural equations, composed of inverse demand and ordinary supply functions at the retail and wholesale levels (see Marsh and Brester, 2004). From the structural equations, the authors defined the general marketing margin relationship as described by equation (1). However, because retail quantity (Q_r) and wholesale quantity (Q_w) are collinear, the authors transformed equation (1) by omitting the retail quantity (Q_r) and separating the wholesale quantity with respect to their sources as shown in equation (2).

(1) $M_{wr}^{j} = \mathrm{m}_1 (Q_r, Q_w, P_s, Y, N, C_L, M_c, P_L, T_w, K_r, K_w)$

(2) $M_{wr}^{j} = \mathrm{m}_2 (Q_{wp}^{j}, Q_{wi}^{j}, Q_{wk}^{j}, Y, N, C_l, M_c, P_l^{j}, Tw, K_r, K_w^{j}, u^{j})$

Where M_{wr} is the wholesale-retail margin, superscript j is equal to beef and pork, Q is the quantity, the subscript *wp* is the wholesale production quantity, *wi* is the wholesale quantity imported , *wk* is the wholesale stocks, P_s is the weighted real price of retail substitutes, Y is the real per capita consumption expenditure, N is the demand for new products/services, C_l is the real food labor costs, M_c is the real food marketing cost excluding labor, P_l is the real price of livestock, T_w is the technology at the processing level, K_r is the retail concentration, K_w is the four firm concentration in meat packing and μ is the random error term. Equation (2) was estimated using the Generalized Least Squares (GLS). The results of the study show that

variables such as consumption expenditure and meat packing concentration depress the margin while meat technology and retail concentration do have a positive effect. However, the econometrics approach used in the study does not allow the observation of all the market forces that produce their total effect on the margin.

1.2.2 *Gardner's (1975) model*

Gardner's study was based on the standard one-product, two inputs model, assuming a perfectly competitive market and a constant return to scale production function. The study uses the Equilibrium Displacement Modeling (EDM) approach to determine the effects of exogenous shocks on prices, margin and the farm-retail price transmission. The EDM approach is based on the concept of elasticity, originally determined by Allen (1938) and Hicks (1957) and applied to agricultural economics by Buse (1958). However, following Muth (1964)'s framework, its application in marketing margin analysis is grounded in Gardner's work.

Gardner's model involves three related markets: retail food, farm output and market services. From six equations of demand and supply in each market, the author derives three fundamental analytical expressions of the farm-retail price transmission elasticity as a result of a shock in retail demand (RD), farm supply (FS) and the marketing services (MS). The farm-retail price transmissions elasticities are shown by equations (3)-(5).

(3) $$\xi^{RD} = \frac{\sigma + S_a e_b + S_b e_a}{\sigma + e_b}$$

(4) $$\xi^{FS} = \frac{S_a(\sigma + e_b)}{e_b + S_a\sigma - S_a\eta}$$

(5) $$\xi^{MS} = \frac{\sigma + e_a}{\sigma + \eta}$$

Where ξ is the ratio between the percentage change in retail price (P_x) and the percentage change in farm price (P_a); σ is the elasticity of substitution between the farm-based input *a* and

the bundle of marketing inputs *b*; e_a is the own-price elasticity of supply for input *a*; e_b is the own-price elasticity of supply for input *b*; η is the own-price elasticity of demand for the retail product *x*; $S_a = P_a a / P_x x$ is the cost share for input *a*; and $S_b = 1 - S_a$ is the cost share for input *b*.

Where $\sigma \geq 0$, $\eta < 0$, $e_a > 0$, $e_b > 0$.

With these equations, he showed that that markup pricing rule cannot represent exactly the farm-retail price spread because shifts may occurs in any of the three sectors in that, the study shows that: a) the effect of demand shifts on the retail-farm price ratio depends on the relative elasticity of supply of farm products and marketing inputs, b) increased supply of farm products increases the ratio, and c) increased supply of marketing inputs decreases the ratio. He also derived results regarding the response of the price ratio to price ceilings and floors, and results that depend on the value of the elasticities of farm and retail demand and on the elasticity of substitution.

The results produced by Gardner are significant as it shows how market forces interact to affect prices and the margin. However, the study does not inform about the controversy related to market concentration.

1.3 Model Specification

The specification of the behavioral marketing margin model employs a modified version of the structural form equations developed by Marsh and Brester (2004). However, following Gardner (1975), this study relies on EDM as an analytical method. Contrary to a purely econometric approach, EDM offers flexibility to researchers in that the functional form should not be a concern if the equilibrium changes are believed to be small (Wohlgenant, 2011). In fact, the changes at the farm level are transmitted to the wholesale level which in turn transmits them

at the retail level. Consequently, following Wohlgenant, our study does not take into account the variables pertaining to wholesale in Marsh and Brester's (2004) model, because the farm-retail margin relationship can be studied given supply and demand functions of the two markets. EDM is based on theoretical assumptions (Brester and Wohlgenant 1997 and Wohlgenant 1993).

In this study, we assume that the market of beef as well as inputs and services used in the two sectors are perfectly competitive in that both farmers and retailers are price takers. The model characterizes the production function of the economic agents as exhibiting a non-constant return to scale production function and a linear supply and demand curve. The study starts with seven structural equations of supply and demand at the retail and farm level, and the margin as presented by equations (6)-(12):

Retail Level

(6) $Q_r^d = D(P_r, \mathrm{Y})$ (Retail demand)

(7) $Q_r^s = D(P_f, P_r, K_r)$ (Retail supply)

(8) $Q_r^d = Q_r^s = Q_r$ (Retail quantity clearing)

Farm Level

(9) $Q_f^d = D(P_f, P_r, K_r)$ (Farm demand)

(10) $Q_f^s = S(P_f, T_f)$ (Farm supply)

(11) $Q_f^d = Q_f^s = Q_f$ (Farm quantity clearing)

(12) $M_{fr} = P_r - P_f$ (Farm to retail marketing Margin)

The model has seven endogenous variables (Q_r^d, Q_r^s, Q_f^d, Q_f^s, P_r, P_f and M) and three exogenous variables (Y, T_f and K_r). At the retail level, equation (6) represents the retail demand curve (Q_r^d) and this is defined in terms of the retail own price (P_r) and consumer income (Y) as a demand shifter; equation (7) is the retail supply curve (Q_r^s), and is a function of retail price (P_r),

farm price (P_f) and the retail concentration ratio (K_r), and equation (8) describes the retail market clearing condition. At the farm level, equation (9) represents the farm demand curve (Q_f^d) and it is a function of the farm own price of demand (P_f), retail price of demand at the farm level (P_r) and retail concentration ratio (K_r). The farm's supply curve is described by equation (10) and is defined in terms of the farm price (P_f) and the farm production technology (T_f), a supply shifter; and equation (11) is the farm market clearing condition. Finally, equation (12) is the marketing margin and it is the difference between retail and farm price. From the structural form equations, the equilibrium displacement equations of the model are derived. The symbol (*) on the variables reflects the relative change (e.g. $Q_r^{d*} = dQ_r^d/Q_r^d$) and the Greek symbols are elasticities. Equations (13)-(19) are the equilibrium displacement equations of the two markets.

Retail level

(13) $Q_r^{d*} = \eta_{rp}P_r^* + \eta_Y Y^*$ (Retail demand)

(14) $Q_r^{s*} = e_{rp}P_r^* + e_{fp}P_f^* + e_K K_r^*$ (Retail supply)

(15) $Q_r^{d*} = Q_r^{s*} = Q_r^*$ (Retail market clearing)

Farm level

(16) $Q_f^{d*} = \lambda_{fp}P_f^* + \lambda_{rp}P_r^* + \lambda_K K_r^*$ (Farm demand)

(17) $Q_f^{s*} = \varepsilon_{fp}P_f^* + \varepsilon_T T_f^*$ (Farm supply)

(18) $Q_f^{d*} = Q_f^{s*} = Q_f^*$ (Farm market clearing)

(19) $M_{fr}^* = (P_r/M)P_r^* - (P_f/M)P_f^*$ (Farm to retail marketing Margin)

Where η_{rp} is the own-price elasticity of demand at retail level; η_Y is the income elasticity at retail level; e_{rp} is the own-price elasticity of supply at retail level; e_{fp} is the farm price elasticity of retail supply; e_K is the supply elasticity of retail concentration ratio at retail level ; λ_{fp} is the own-price elasticity of demand at farm level; λ_{rp} is the retail price elasticity of farm demand; λ_K is the retail concentration elasticity of farm demand; ε_{fp} is the own-price elasticity of supply at farm level; and ε_T is the supply elasticity of production technology at farm level.

Where: $\eta_Y, e_{rp}, \varepsilon_{fp}, \lambda_{rp}$ and $\varepsilon_T > 0$ and $\eta_{rp}, e_{fp}, \lambda_{fp}$, e_K and $\lambda_K < 0$.

The displaced form of the structural equations suggests that, holding all other factors constant, increasing market concentration (K_r^*) may contribute to reduced quantity supplied at the retail level (equation (14)) more than that of a purely competitive market situation, so that the few big firms are able to exert market power through retail pricing. Similarly, rising market concentration (K_r^*) will negatively impact the quantity demanded at farm level [equation (16)]. Beef is widely consumed in the U.S. and is considered as a normal good. Consequently, a growth in income (Y^*) would lead to an increase in quantity demanded at the retail level. Following the market linkage structure, a rise in quantity demanded at the retail level would lead to an increase in the quantity demanded and price at the farm level. By contrast, increase in farm production technology (T_f^*) would lead to an increase in the quantity supplied at the farm level and a decrease in its price. These impacts will be transmitted upstream at the retail level, and retail quantity supplied will increase while its price will decline accordingly.

We take advantage of the flexibility offered by EDM to use pre-existing estimated elasticities reported in the literature (see table 1.3). However, the literature offers little if not none retail concentration elasticity. Consequently, the first step of this study will focus on the estimation of the impact of retail concentration ratio on quantities. The supply elasticity of retail

concentration at retail level (e_K) is estimated using equation (14) while equation (16) allows to estimate retail concentration elasticity of farm demand (λ_K).

1.4 Methods and Estimation procedures

A quick pre-test on the time series data of the equation models using the Augmenting Dickey Fuller (ADF) testing the null hypothesis of the existence of a unit root suggests that the series are non-stationary[1]. A regression with such series is a spurious regression (Granger and Newhold (1974), Dickey, Hasza and Fuller (1984)). Johansen co-integration test however, shows that the series are co-integrated[2], implying the existence of a long run relationship among the variables. Hence, the existence of an error correction model (ECM).

Following Cunddington and Dagher (2015), isomorphic ECMs are determined using equations (14) and (16). This modeling approach, compared to previous ECMs does not necessitate the use of the delta method to compute the standards errors of the long run impacts. They are obtained instantly using non-linear least squares.

Using a general-to-specific approach modeling, based on Akaike Information Critirion (AIC) and Lagrange Multiplier (LM) statistics for testing the hypothesis of no serial correlation for optimal lag selection, equations (14), augmented by including the variable oil price (OP), is rewriting as ARDL (1 2 2 2 2) to give the retail supply equation (14b) below:

$$(14b) \qquad Q_{r_t}^{s*} = \gamma_0 + \gamma_{q_1} Q_{r_{t-1}}^{s*} + \gamma_{r_0} P_{r_t}^{*} + \gamma_{r_1} P_{r_{t-1}}^{*} + \gamma_{r_2} P_{r_{t-2}}^{*} + \gamma_{f_0} P_{f_t}^{*} + \gamma_{f_1} P_{f_{t-1}}^{*} + \gamma_{f_2} P_{f_{t-2}}^{*} + \gamma_{K_0} K_{r_t}^{*} + \gamma_{K_1} K_{r_{t-1}}^{*} + \gamma_{K_2} K_{r_{t-2}}^{*} + \gamma_{op_0} OP^{*}{}_t + \gamma_{op_1} OP^{*}{}_{t-1} + \gamma_{op_2} OP^{*}{}_{t-2}$$

Note: (1) The results of the unit roots and (2) the results co-integration tests are not reported here but can be obtained from the authors upon request. Akaike Information Critirion (AIC = -160.530) and the Lagrange Multiplier (LM) statistics for testing the null hypothesis of no serial correlation (χ^2 (1) = 1.925 and p-value = 0.165) are used to select the lag length in model (14b).

Based on equation (14b), the long run elasticities (ωs) are calculated as follow:

(14b$_1$) $$\omega_r = e_{rp} = \frac{\gamma_{r_0} + \gamma_{r_1} + \gamma_{r_2}}{1 - \gamma_{q_1}}$$

(14b$_2$) $$\omega_f = e_{fp} = \frac{\gamma_{f_0} + \gamma_{f_1} + \gamma_{f_2}}{1 - \gamma_{q_1}}$$

(14b$_3$) $$\omega_k = e_K = \frac{\gamma_{k_0} + \gamma_{k_1} + \gamma_{k_2}}{1 - \gamma_{q_1}}$$

(14b$_4$) $$\omega_{op} = e_{op} = \frac{\gamma_{op_0} + \gamma_{op_1} + \gamma_{op_2}}{1 - \gamma_{q_1}}$$

However, as suggested by Cundington and Dagher (2015), these coefficients and their standard errors can thereafter be estimated directly using an isomorphic ECM as presented by equation (14c) below:

(14c) $$\Delta Q^{s*}_{r_t} = \gamma_0 + \lambda(\omega_r P^*_{r_{t-1}} + \omega_f P^*_{f_{t-1}} + \omega_k K^*_{r_{t-1}} + \omega_{op} OP^*_{t-1} - Q^{s*}_{r_{t-1}}) + \gamma_{r_0}\Delta P^*_{r_t} - \gamma_{r_2}\Delta P^*_{r_{t-1}} + \gamma_{f_0}\Delta P^*_{f_t} - \gamma_{f_2}\Delta P^*_{f_{t-1}} + \gamma_{k_0}\Delta K^*_{r_t} - \gamma_{k_2}\Delta K^*_{r_{t-1}} + \gamma_{op}\Delta OP^*_t - \gamma_{op_2}\Delta OP^*_{t-1}$$

Where $\lambda = (1 - \gamma_{q_1})$ is a speed of adjustment parameter, and the coefficients γ on Δ are the short run elasticities.

Using the same procedure, equation (16) permits to determine the isomorphic ECM model for farm demand equation (16b) based on ARDL (1 2 2 2) as shown below:

(16b) $$\Delta Q^{d*}_{f_t} = \gamma_0 + \lambda(\acute{\omega}_r P^*_{r_{t-1}} + \acute{\omega}_f P^*_{f_{t-1}} + \acute{\omega}_k K^*_{r_{t-1}} - Q^{d*}_{r_{t-1}}) + \acute{\gamma}_{r_0}\Delta P^*_{r_t} - \acute{\gamma}_{r_2}\Delta P^*_{r_{t-1}} + \acute{\gamma}_{f_0}\Delta P^*_{f_t} - \acute{\gamma}_{f_2}\Delta P^*_{f_{t-1}} + \acute{\gamma}_{k_0}\Delta K^*_{r_t} - \acute{\gamma}_{k_2}\Delta K^*_{r_{t-1}}$$

Where the $\acute{\omega}$s are the long run elasticities and the coefficients $\acute{\gamma}$s on Δ are their short run counterparts.

Note: Akaike Information Critirion (AIC = -146) and the Lagrange Multiplier (LM) statistics for testing the null hypothesis of no serial correlation (χ^2 (1) = -0.004 and p-value = 0.950) are used to select the lag length.

1.5 Comparative Static

In what follows, analytical solutions for reduced-form elasticities are given to display how the basic model works by deriving incidence relationships for the case where interrelationships are ignored. From the displaced equations, the general equilibrium demand curve for farm output (Q_f^{d*}) is determined by dropping equation (16) and solving the remaining equations simultaneously. Setting equation (13) equal to equation (14), allows to solve for the farm- retail price transmission [equation (20)] which will be substituted into equation (11) to determine the general equilibrium for the farm demand curve [equation (21)]. Using a similar procedure, equations (16) and (17) can be employed to determine P_f^* [equation (22)].

(20) $$P_r^* = \frac{\eta_Y}{e_{rp}-\eta_{rp}} Y^* - \frac{e_{fp}}{e_{rp}-\eta_{rp}} P_f^* - \frac{e_K}{e_{rp}-\eta_{rp}} K_r^*$$

(21) $$Q_f^{d*} = \frac{\lambda_{fp}\,(e_{rp}-\eta_{rp})-\lambda_{rp}e_{fp}}{e_{rp}-\eta_{rp}} P_f^* + \frac{\lambda_{rp}\,\eta_Y}{e_{rp}-\eta_{rp}} Y^* + \frac{\lambda_k(\,e_{rp}-\eta_{rp})-\lambda_{rp}e_K}{e_{rp}-\eta_{rp}} K_r^*$$

(22) $$P_f^* = \frac{\lambda_{rp}}{\varepsilon_{fp}-\lambda_{fp}} P_r^* - \frac{\varepsilon_T}{\varepsilon_{fp}-\lambda_{fp}} T_f^* + \frac{\lambda_K}{\varepsilon_{fp}-\lambda_{fp}} K_r^*$$

Equations (20) and (22) show that retail price and farm price are embedded into each other. In fact, the coefficients of these relative prices can be taken as the price transmission elasticities from one market to the other. Both prices are directly affected by a shock in retail concentration ratio. Consumer income has a direct impact on retail price (P_r^*) and farm price (P_f^*) is directly affected by the farm production technology. However, through the price linkage equations, the three exogenous variables impact both prices. Income (Y^*) indirectly impacts P_f^* through P_r^*, and T_f^* indirectly affects P_r^* through P_f^*.

Equations (20) and (22) are the quasi-reduced form equations for prices, and are fundamental in explaining the movement in prices and the margin. Nevertheless, limiting the

analysis at this stage will not permit to display the full information on the dynamism through which exogenous shocks affect endogenous variables. Holding consumer income constant and allowing retail price to adjust, equation (16) suggests that the retail concentration (K_r^*) solely depress the farm quantity demanded, but equation (21) shows that its impact on the general equilibrium of the farm demand curve, as a result of a joint effects of supply and demand elasticities of the two markets, is undefined. Conversely, holding retail concentration(K_r^*) constant, income increases the quantity demanded in both equations.

Equations (14) and (16) are homogenous of degree zero in prices in that, $e_{rp} + e_{fp} = 0$ => $e_{rp} = -e_{fp}$; and $\lambda_{fp} + \lambda_{rp} = 0$ => $\lambda_{fp} = -\lambda_{rp}$

This homogeneity restriction can be used to simplify the general equilibrium demand curve for farm output Q_f^{d*} as shown by equation (23):

(23) $$Q_f^{d*} = \frac{-\lambda_{fp}\eta_{rp}}{e_{rp}-\eta_{rp}} P_f^* - \frac{\lambda_{fp}\eta_Y}{e_{rp}-\eta_{rp}} Y^* + \frac{\lambda_{fp}e_K+\lambda_k(e_{rp}-\eta_{rp})}{e_{rp}-\eta_{rp}} K_r^*$$

Setting the general equilibrium demand curve for farm output (Q_f^{d*}) equal to supply curve of farm output [equation (18)] permits the determination of the reduced form equation for farm price (P_f^*) in terms of the three exogenous variables Y^*, T_f^* and K_r^* [equation (24)]. The reduced form equation for retail price [equation (25)] is obtained by substituting the reduced form equation of farm price (P_f^*) into the farm-retail price transmission [equation (20)]. Substituting equations (24) and (25) into equation (19) gives the relative change in the farm-retail margin [equation (26)].

(24) $$P_f^* = \frac{-\lambda_{fp}\eta_Y}{D} Y^* - \frac{\varepsilon_T(e_{rp}-\eta_{rp})}{D} T_f^* + \frac{\lambda_k(e_{rp}-\eta_{rp})+e_K\lambda_{fp}}{D} K_r^*$$

(25) $$P_r^* = \frac{\eta_Y(\varepsilon_{fp}-\lambda_{fp})}{D} Y^* - \frac{\varepsilon_T e_{rp}}{D} T_f^* + \frac{\lambda_k e_{rp}-e_K(\varepsilon_{fp}-\lambda_{fp})}{D} K_r^*$$

(26) $M_{fr}^* = w_r * P_r^* - w_f * P_f^*$, where $w_r = (P_r/M)$ and $w_f = (p_f/M)$

Where D = $\varepsilon_{fp}\ (e_{rp} - \eta_{rp}) + \lambda_{fp}\ \eta_{rp} > 0$

Equations (24)-(26) reveal first, the direction in which the set of exogenous variables pushes prices and the margin, and second, on which particular parameters of the market the exogenous variables depend. P_r^*, P_f^* and M_{fr}^* are the analytical solutions of the model and are determined as a function of the total impact of each exogenous variable.

From a comparative static analysis standpoint, equations (24)-(26) generate three cases:

Case (A): $\frac{P_f^*}{Y^*} = \frac{-\lambda_{fp}\eta_Y}{D} > 0$ and $\frac{P_r^*}{Y^*} = \frac{\eta_Y(\varepsilon_{fp}-\lambda_{fp})}{D} > 0$

Case (B): $\frac{P_f^*}{T_f^*} = -\frac{\varepsilon_T(e_{rp}-\eta_{rp})}{D} < 0$ and $\frac{P_r^*}{T_f^*} = -\frac{\varepsilon_T e_{rp}}{D} < 0$

Case (C): $\frac{P_f^*}{K_r^*} = \frac{\lambda_k(e_{rp}-\eta_{rp})+e_K\lambda_{fp}}{D}$ and $\frac{P_r^*}{K_r^*} = \frac{\lambda_k e_{rp}-e_K(\varepsilon_{fp}-\lambda_{fp})}{D}$ are undefined

Case (A) implies that a growth in consumer income increases the relative prices in both sectors. However, because the increase in retail price is larger compared to the increase in the farm price, a growth in income would result in widening the margin. In fact, income impacts the numerator of farm price through the quantity demanded at the farm level by an amount of the product between the farm own price elasticity of demand and the income elasticity at retail level ($-\lambda_{fp}\ \eta_Y$). On the opposite side, retail price increases by an additional amount of the product between own price elasticity of supply at farm level and the income elasticity at retail level, producing $\eta_Y(\varepsilon_{fp} - \lambda_{fp}) > -\lambda_{fp}\ \eta_Y$. Put in different way, a shift in retail demand increases retail price more than it increases farm price. Since $w_r > w_f$, it can be shown from equation (26) that a growth in income will result in an upward shift in the marketing margin;

Case (B) shows that $\frac{P_f^*}{T_f^*}$ and $\frac{P_r^*}{T_f^*} < 0$ and demonstrate that a shift in the farm production technology decreases the price in both markets and this could be explained by the supply effect. However, the decrease in the farm price is much larger in absolute terms compared to the decrease in retail price in that ($\left|-\varepsilon_T(e_{rp}-\eta_{rp})\right| > \left|-\varepsilon_T e_{rp}\right|$). As a result, the margin gets larger;

Case (C) suggests that the signs on $\frac{P_f^*}{K_r^*}$ and $\frac{P_r^*}{K_r^*}$ are ambiguous, meaning that the impact of a shock in retail concentration ratio (K_r^*) on prices is undefined. This suggests that the model does not yield a hypothesis effect on the exogenous variable (K_r^*). When revisiting the reduced form equations, we can observe that the impact of retail concentration on the numerator of each price is a result of a "hybrid impact" due to: a) a shift in retail concentration on retail output supplied (e_K) and b) a shift in retail concentration on the farm quantity (λ_k). For example, in the farm price equation (P_f^*), the portion of the impact represented by $\lambda_k(e_{rp} - \eta_{rp})$ is due to an isolated shift in retail concentration on the farm quantity demanded and the portion represented by $e_K\lambda_{fp}$ is due to a shift in retail concentration on retail output supplied. On the other hand, it can be shown that in the retail price, $e_{rp}\lambda_k$ is the impact due to a shift in retail concentration on farm quantity demanded. The shift in retail concentration on retail output supplied produce an effect represented by $e_K(\varepsilon_{fp} - \lambda_{fp})$.

In fact, the impact of retail concentration on prices can be well identified by first suppressing the shift in retail supply function and leaving only the shift on the farm demand function and vice versa. Scenarios (1) and (2) illustrate these cases and scenario 3 shows the range at which retail concentration could increase prices and decreases the margin.

Scenario 1: When $e_K = 0$, market concentration does not affect retail quantity supplied but has an effect on the quantity demanded at farm level (through λ_k). This case occurs under: a) retail exerting a monopsony power in order to affect farm price; b) as demand decreases at retail level, retail decreases its demand at the farm level; or c) increase in U.S. farm price leads retail to import a fraction of beef from cheap sources. Under this scenario, a shift in market concentration depresses the price in both markets.

Scenario 2: When λ_k = 0, market concentration does not affect the farm quantity demanded but has an impact on retail quantity supplied (through e_K). In this case, retail supplied is depressed, leading to an increase of its price. In fact, under this scenario, prices in both markets increase when market concentration increases.

Scenarios 1 and 2 suggest that retail uses a balanced approach: market power and cost saving in their activity. Consequently, market concentration should not be taken only as market power but also as cost efficiency.

Scenario 3: If retail concentration ratio increase/decrease prices, and then the margin will depend on the sensitivity of supply and demand in both market. However, equation (26) allows obtaining the value at which market concentration will not affect the margin, and is given by equation (27):

(27) $$\lambda_k > \frac{(w_r \varepsilon_{fp} - A\lambda_{fp})e_K}{Ae_{rp} - w_f \eta_{rp}}$$

Where A = w_r - w_f

Given the source of the shift in the retail demand, farm supply and the retail concentration ratio, the ratio of retail price [equation (25)] to farm price [equation (24)] gives the farm-retail price transmission elasticities as shown by equations (28)-(30):

(28) $$\xi^{RD} = \frac{P_r^*/Y^*}{P_f^*/Y^*} = \frac{\varepsilon_{fp} - \lambda_{fp}}{-\lambda_{fp}} > 1$$

(29) $$\xi^{FS} = \frac{P_r^*/T_f^*}{P_f^*/T_f^*} = \frac{e_{rp}}{e_{rp} - \eta_{rp}} \geq 0$$

(30) $$\xi^{MS} = \frac{P_r^*/K_r^*}{P_f^*/K_r^*} = \frac{e_{rp}\lambda_k - e_K(\varepsilon_{fp} - \lambda_{fp})}{(e_{rp} - \eta_{rp})\lambda_k + e_K\lambda_{fp}}$$ undefined

The analytical expressions for the price transmission elasticities displayed in equations (28)-(30) show that retail price responds instantly to changes in farm price. However, the magnitude of the response depends on the source of the shock. $\xi^{RD} > 1$ and $\xi^{FS} \geq 0$ suggest that the price transmission elasticity under retail demand shock is much larger compared to a

shock in the farm's supply, in that the change in retail price as a result of a change in a 1percent change in farm price is much larger and positive under a shift in consumer income compared to a shift in the farm production technology. As noted previously, the sign and the magnitude of the change in prices under a shock in retail concentration is undefined, and this situation is carried on to the price transmission elasticities. When market concentration does not affect retail supply ($e_K = 0$) but impact only farm quantity, ξ^{MS}equal ξ^{FS}. However, if it does not affect the quantity demanded at farm level (λ_k= 0), but affect only retail supply, in this case, ξ^{MS} equal ξ^{RD}.

The reduced form equation for the retail quantity can be obtained by first deriving the quasi-reduced form equation. Substituting equation (20) into equation (14) gives the quasi-reduced form equation for retail (equation (31). Replacing the farm price (P_f^*) in this equation by its reduced form expression gives the reduced form equation for retail quantity (equation 33). With a similar approach, the quasi- reduced form equation for farm quantity (32) can be obtained by substituting equation (22) into equation (17). The reduced form expression for farm quantity (equation 34) is then obtained by substituting the reduced form expression of retail price (p_f^*) into equation (32) gives:

(31) $$Q_r^* = \frac{e_{rp}\eta_Y}{e_{rp}-\eta_{rp}} Y^* + \frac{e_{rp}\eta_{rp}}{e_{rp}-\eta_{rp}} P_f^* - \frac{e_K\eta_{rp}}{e_{rp}-\eta_{rp}} K_r^*$$

(32) $$Q_f^* = \frac{-\varepsilon_{fp}\lambda_{fp}}{\varepsilon_{fp}-\lambda_{fp}} P_r^* - \frac{\lambda_{fp}\varepsilon_T}{\varepsilon_{fp}-\lambda_{fp}} T_f^* + \frac{\varepsilon_{fp}\lambda_K}{\varepsilon_{fp}-\lambda_{fp}} K_r^*$$

Equations (31) and (32) are the quasi reduced form equations for quantities and are helpful for simulating the model using Cramer's rule whilst equations (33) and (34) are the reduced form expressions for quantities of the model.

(33) $$Q_r^* = \frac{e_{rp}\,\varepsilon_{fp}\,\eta_Y}{D} Y^* - \frac{e_{rp}\eta_{rp}\,\varepsilon_T}{D} T_f^* + \frac{\lambda_k e_{rp}\eta_{rp} - e_K\eta_{rp}(\,\varepsilon_{fp}-\lambda_{fp})}{D} K_r^*$$

(34) $$Q_f^* = \frac{-\,\varepsilon_{fp}\lambda_{fp}\eta_Y}{D} Y^* + \frac{\lambda_{fp}\eta_{rp}\,\varepsilon_T}{D} T_f^* + \frac{\varepsilon_{fp}\,[\lambda_k(\,e_{rp}-\eta_{rp}\,)+\,e_K\lambda_{fp}]}{D} K_r^*$$

Equations (33)-(34) indicate the economic forces that govern the response of the endogenous variable to the specified exogenous variable. They show that the impact of each exogenous variable on the endogenous variables is a by-product effect of elasticities. As in the price equations, the denominator does not display a clear intuitive economic interpretation.

Following Cramer's rule, the quantitative solution of the model is obtained by simulating the matrices from the quasi-reduced form equations after enforcing the homogeneity restriction in equations (20) and (21) as demonstrated by equation (35). By adopting this approach, the quantitative total effect of the exogenous shifts on quantities, prices and margin can be determined.

$$\begin{bmatrix} 1 & 0 & \frac{-e_{rp}}{e_{rp}-\eta_{rp}} & 0 & 0 \\ 0 & 1 & \frac{-e_{rp}\eta_{rp}}{e_{rp}-\eta_{rp}} & 0 & 0 \\ \frac{-\lambda_{fp}}{\varepsilon_{fp}-\lambda_{fp}} & 0 & 1 & 0 & 0 \\ \frac{\varepsilon_{fp}\lambda_{fp}}{\varepsilon_{fp}-\lambda_{fp}} & 0 & 0 & 1 & 0 \\ -w_r & 0 & w_f & 0 & 1 \end{bmatrix} \begin{bmatrix} P_r^* \\ Q_r^* \\ P_f^* \\ Q_f^* \\ M_{fr}^* \end{bmatrix} = \begin{bmatrix} \frac{\eta_Y}{e_{rp}-\eta_{rp}} & \frac{-e_K}{e_{rp}-\eta_{rp}} & 0 \\ \frac{e_{rp}\eta_Y}{e_{rp}-\eta_{rp}} & \frac{-e_K\eta_{rp}}{e_{rp}-\eta_{rp}} & 0 \\ 0 & \frac{\lambda_k}{\varepsilon_{fp}-\lambda_{fp}} & \frac{-\varepsilon_T}{\varepsilon_{fp}-\lambda_{fp}} \\ 0 & \frac{\varepsilon_{fp}\lambda_k}{\varepsilon_{fp}-\lambda_{fp}} & \frac{-\varepsilon_T\lambda_{fp}}{\varepsilon_{fp}-\lambda_{fp}} \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} Y^* \\ K_r^* \\ T_f^* \end{bmatrix}$$

(35) $$A^*Y = B^*X$$

Where **A** is a 5 x 5 matrix containing exclusively the coefficients of the endogenous variables; **Y** is 5 x 1 matrix vectors of prices, quantities and margin; **B** is a 5 x 3 matrix containing the coefficients on the exogenous variables and X is a 3 x 1 vector of exogenous variables. The reduced form elasticities of the model will be contained in a 5 x 3 matrix after inversing **A** in equation (35) and multiplying it by **B**. This implies that $\mathbf{Y=A^{-1}*BX}$ is the solution of the model. We later simulate the model by varying the price elasticity of supply and demand in the two markets subsequently while holding all others parameters of the model constant. The objective of

these simulations is to investigate the change in the endogenous variables when one parameter of the market changes.

1.6 Data

The dataset used in this EDM simulation are elasticity values rather than attempting to estimate income elasticity, own-price elasticity of retail demand and the supply elasticity of farm technology, following Lusk and Anderson (2004) and Wohlgenant (1993), the study relies on pre-existing estimated elasticities reported in the literature (table 1.3). Using data covering the time period 1980-2010, retail supply equation (14) and farm demand equation (16) help estimating the remaining elasticities.

Data on retail supply quantity (Q_r^s), and farm demand quantity (Q_f^d), measured in millions pounds, were obtained from the Economic Research Service of the United States Department of Agriculture (ERS-USDA). Similarly, retail price (P_r) and farm price (P_f) are originated from ERS-USDA and are measured in Cents per pound. The four firm concentration ratio (K_r) are provided by USDA/Packers and Stockyards Administration. It measures the share of the market occupied by the top four larger firms and is measured in percent. Finally, the variable domestic price of crude oil (*OP)* is obtained from the U.S. Energy Information Administration and is measured in Dollars per barrel.

1.7 Results and Discussions

This section starts by presenting the econometric results before discussing the EDM simulation results. In fact, the econometric results will only be discussed briefly. The discussions of the results will focus on the more develop reduced formed coefficients in the EDM simulation, and how these coefficients impact quantities, prices and the marketing margin.

Table 1.1 shows that the impacts of the estimated long run elasticities of the models are all significant compared to their short run counterparts. The results suggest that in the long run, an increase in market concentration as well as an increase in farm price and oil price, all depress retail quantity ratio, supplied. Specifically, retail quantity supplied decreases by 0.18, 0.64 and 0.17 percent as a result of 1 percent increase in retail concentration farm price and oil price respectively. Similarly, table 1.2 indicates that retail concentration ratio and farm price significantly decrease the quantity demanded at the farm level. An increase in retail concentration by 1 percent is followed by a decrease in farm quantity by 0.25 percent while an increase by 1 percent in farm price depresses farm quantity by about 0.87 percent, larger than the value of 0.54 obtained by Brester et al. (2004) or a value of 0.62 recorded by Marsh et al. (2003). On the opposite side, an increase in retail price leads to an increase in retail quantity supplied (table 1.1) as well as an increase in quantity demanded at the farm level (table 1.2). Retail quantity supplied rise by 0.71 percent and farm quantity increases by 0.73 percent when retail supply price increases by 1 percent.

The econometric results, incorporated in the EDM simulation, give the results displayed in table 1.4 and show some similarities with that of Marsh and Brester (2004) in that consumer income, farm production technology and the four firm concentration ratio all produces a positive impact on the margin.

1.7.1 *Impact of the change in consumer income*

Results displayed in table 1.4 show that an increase in income has a positive effect on the endogenous variables of the model. However, the impact on the quantity is more pronounced at the farm level, while on the price side, it is much larger at the retail level. When income increases by 10 percent, retail quantity and price increase by about 0.21 and 1.47 percent

respectively. In fact, this increase in retail price is smaller compared to an increase by about 2.53 percent determined by Marsh (1992) but larger than a value of 1 percent estimated by Hosseini and Shahbazi (2010).

The positive impact of income on quantity and price at the retail level is transmitted downstream at the farm level. A 10 percent increase in income is followed by a rise in farm quantity demanded by about 0.26 percent while price changes by about 1.17 percent. This positive impact of income in both markets is consistent with the economic theory of demand. Beef is considered a normal good, thus, a growth in income would lead to an increase in quantity demanded, resulting in an upward shift in its price with supply being constant. However, the results indicate that income increases retail price more than it raises the farm price, leading to an increase in the margin by about 1.78 percent.

Equations (24 - 25) suggest that the effect of income on prices depends on the sensitivity of supply and demand to prices in the two markets. Notably, the less elastic the demand at the farm level to own price, the more pronounced will be the impact of a change in income on farm price and the margin. Table 1.5 shows that when income grows by 10 percent, retail price decreases slightly from 1.47 percent to 1.37 percent while farm price decreases from 1.17 percent to 1 percent. This suggests that farm price decreases faster than retail price, as such, the margin increases slightly from 1.78 percent to 1.80 percent. On the opposite site, a less elasticity farm supply suggests that the growth in farm price is more than that of retail price, leading to a slight decrease in the margin from 1.78 percent to 1.77 percent when income increases by 10 percent (table 1.5). At the retail level, a less elasticity retail demand suggests that the growth in retail price is more than that of farmer price, leading to an increase in the margin by about 1.86 percent when income increases by 10 percent (table 1.6). Furthermore, table 6 shows that when

retail supply is less elastic, retail price increases faster compared to farm price and the margin grows wider and reaches 1.94 percent when income increase by 10 percent.

Table (5) also shows a price transmission elasticity of 1.41, suggesting that the increase in retail price as a result of 1 percent increase in farm price is much higher with a less elastic farm demand compared a more elastic demand where the price transmission elasticity is about 1.25.

1.7.2 *Impact of farm production technology*

The results displayed in table (1. 4) shows that the signs of the coefficients on quantities and prices are consistent with theoretical economic reasoning in that, an increase in supply is followed by a decrease in its price and vice versa. The results show that a shock in the farm production technology by 10 percent increases the farm quantity of beef by 0.67 percent and decreases its price by about 1.51 percent, smaller than a decrease of 2.2 percent obtained by Marsh (2003). Similarly, a 10 percent increase in the farm production technology increases retail quantity by about 0.55 percent while the price declines by 0.74 percent. Thus, the decrease in farm price is larger compared to the decrease in retail price. However, this increase in farm price is not large enough to decrease the margin. The margin increases slightly by about 0.07 percent as the production technology increases by 10 percent, relatively smaller than the value of 2.8 percent obtained by Brester and Marsh (2001) for the wholesale-retail margin. This result can be explained by a relatively small value of the farm production technology elasticity adapted from Berster et al. (2009).

The results displayed in table (1.5) show that when demand and supply at farm level are less elastic, the margin get smaller. When the production technology increases by 10 percent, the margin increases by 0.09 percent and 0.08 percent for the less elastic farm demand and supply respectively. On the opposite side, table (6) shows that at retail level, less elastic demand shrinks

the margin while a less elastic supply increases it. Compared to the results in table 1.4, the margin decreases from 0.07 percent to 0.03 percent when retail demand is less elastic and it increases from to 0.07 to 0.5 percent when retail supply is less elastic.

1.7.3 *Impact of the Four Firm Concentration Ratio*

Table 1.4 indicates that a shift in retail concentration ratio decreases quantities in both markets. However, the impact on prices is mixed. At the farm level, price declines as retail concentration ratio increases compared to the results observed at the retail level where this shock produces a positive impact on price. An increase in retail concentration by 10 percent leads to a decrease by about 0.14 percent in the quantity and an increase by about 0.19 percent in the price at the retail level. At the farm level, the quantity decreases by about 0.47 percent and the price decline by 2.14 percent given a 10 percent increases in retail concentration ratio. With this shock, the farm-retail margin is positive and corresponds to an increase of about 2.64 percent.

The change in retail price as a result of a change in the farm price is noticeable. Table 1.4 shows that retail price does not fully decrease by the amount of a decrease in farm price. Furthermore, table 6 shows that the impact of retail concentration on the margin is more pronounced when retail supply is less elastic. The margin increase by 3.86 percent as a result of 10 percent increases in retail concentration. The impact of retail concentration on prices can be subdivided into two parts as shown in table 1.7. When retail concentration ratio affects only the farm quantity demanded (scenario 1), the decrease in farm price is much larger compared to a decrease in retail price, specifically, when retail concentration increases by 10 percent, retail price decreases by about 1.8 percent and the farm price decline by 3.76 percent. On the other hand, when retail concentration affects only retail quantity supplied (scenario 2), retail price

increases by 2.03 percent and farm price decreases by 1.63 percent. Since the increase in retail price outweighs that of farm price, retail concentration has a positive impact on the margin.

1.8 Concluding Remarks

This study has developed a conceptual and empirical framework for analyzing the marketing margin of beef. The results from a theoretical point of view are acceptable as the farm-retail marketing margin is derived from subtracting the retail price from the farm price. There is a linear relationship between retail price and the margin, and an increase in retail price results in an increase in the margin. The study shows that all the exogenous shifts of the model increase the margin and this is explained by retail price adjusting to increase in farm price.

This work is one of the first to analytically determine the effect of retail concentration ratio on farm-retail marketing margin of beef. The procedures employed shed light on the mechanism through which retail concentration interacts with other market forces to determine the direction and the magnitude of the margin. This study does not contradict the findings by Marsh and Brester (2004) which indicate that retail concentration increases the marketing margin of beef. However, it is important to point out that in order to gain a large share of the market, the top firms in the market devoted significant investment into their production technology, transportation and handling and other marketing channels. In this case, an increase in the margin should not be attributed only to retail as exercising a market power but also because of its cost efficiency.

The study provides some specific results a) an exogenous shift that increases retail demand increases retail price more than it increases the farm price, leading to an increase in the margin; b) an exogenous shift that increases farm supply decreases farm price more than it decreases retail price, resulting in an increase in the margin; c) an exogenous shift that decreases

retail quantity supplied and decreases farm quantity demanded increases retail price more than it increases farm price and consequently increases the margin.

Table 1.1: Econometric estimate of ECM for retail quantity supplied

Variable/ parameter	Coefficient	Std Error	P-value	Long run coefficient
C	4.737	1.284	0.002	
λ	0.460	0.133	0.004	***Adjustment parameter***
ω_k	-0.179	0.052	0.003	***LR elasticity of*** K_r
ω_f	-0.643	0.165	0.001	***LR elasticity of*** P_f
ω_r	0.710	0.181	0.001	***LR elasticity of*** P_r
ω_{op}	-0.170	0.045	0.002	***LR elasticity for OP***
γ_{k_0}	-0.068	0.073	0.366	
γ_{k_2}	-0.008	0.073	0.910	
γ_{f_0}	-0.192	0.076	0.023	
γ_{f_2}	0.161	0.073	0.043	
γ_{r_0}	-0.043	0.142	0.766	
γ_{r_2}	-0.229	0.126	0.090	
γ_{op}	-0.022	0.018	0.231	
γ_{op_2}	-0.050	0.018	0.013	

$R^2 = 0.80$ Adjusted $R^2 = 0.63$

Table 1.2: Econometric estimate of ECM for farm demand quantity

Variable/ parameter	Coefficient	Std Error	P-value	Long run coefficient
C	2.022	0.728	0.012	
λ	0.307	0.135	0.036	***Adjustment parameter***
$\acute{\omega}_k$	-0.252	0.104	0.027	***LR elasticity of*** K_r
$\acute{\omega}_f$	-0.870	0.294	0.008	***LR elasticity of*** P_f
$\acute{\omega}_r$	0.732	0.284	0.019	***LR elasticity of*** P_r
$\acute{\gamma}_{r_0}$	-0.161	0.178	0.379	
$\acute{\gamma}_{r_2}$	0.083	0.143	0.569	
$\acute{\gamma}_{f_0}$	-0.113	0.096	0.254	
$\acute{\gamma}_{f_2}$	-0.181	0.094	0.070	
$\acute{\gamma}_{k_0}$	-0.162	0.088	0.082	
$\acute{\gamma}_{k_2}$	0.017	0.087	0.844	

$R^2 = 0.76$ Adjusted $R^2 = 0.64$

Table 1.3: Parameters Values used in the Simulation

Parameters	Notation	Values	Sources
own-price elasticity of demand at retail level	η_{rp}	-0.74 (-0.70[a])	Brester et al. (2009)
own-price elasticity of demand at farm level	λ_{fp}	-0.87 (-0.54[a])	Estimated
income elasticity at retail level	η_Y	0.13	Brester et al. (1995)
own-price elasticity of supply at retail level	e_{rp}	0.71 (0.36[a])	Estimated
own-price elasticity of supply at farm level	ε_{fp}	0.14 (0.22[b])	Brester et al. (2009)
supply elasticity of farm technology	ε_T	0.10	Brester et al. (2009)
supply elasticity of retail concentration at retail level	e_K	-0.18	Estimated
retail concentration elasticity of farm demand	λ_k	-0.25	Estimated
Ratio of retail price to margin	w_r	2.04	Estimated
Ratio of farm price to margin	w_f	1.04	Estimated

(a) indicates that the data is extracted from Brester et al. (2004) and (b) indicates that the data is extracted from Marsh (2009)

Table 1.4: Impact of income, farm technology and retail concentration on quantities, prices, marketing margin and the price transmission.

Variable	Income	Farm production technology	Retail concentration ratio
Retail quantity	0.021	0.055	-0.104
Farm quantity	0.026	0.067	-0.047
Retail price	0.147	-0.074	0.019
Farm price	0.117	-0.151	-0.214
Margin	0.178	0.007	0.264
Price transmission elasticity	1.253	0.49	-0.091

Table 1.5: Impact of a less elastic farm demand and a less elastic farm supply on quantities, prices, marketing margin and the price transmission.

Variables	Income		Farm technology		Retail concentration	
	λ_{fp} = -0.54; ε_{fp} = 0.14		λ_{fp} = -0.54; ε_{fp}= 0.14		λ_{fp}= -0.54; ε_{fp}= 0.14	
Retail quantity	0.028	0.015	0.073	0.062	0.042	-0.004
Farm quantity	0.021	0.018	0.056	0.076	-0.081	-0.034
Retail price	0.137	0.155	-0.099	-0.084	-0.057	0.005
Farm price	0.097	0.134	-0.202	-0.171	-0.369	-0.243
Margin	0.180	0.177	0.009	0.008	0.272	0.266
Price*	1.407	1.161	0.491	0.491	0.153	-0.021

Note: Price* stands for price transmission

Table 1.6: Impact of a less elastic demand and supply at the retail level on quantities, prices, marketing margin and the price transmission.

Variables	Income		Farm technology		Retail concentration	
	η_{rp}= -0.70; e_{rp} = 0.36		η_{rp}= -0.70; e_{rp}= 0.36		η_{rp}= -0.70; e_{rp}=0.36	
Retail quantity	0.022	0.011	0.054	0.030	-0.014	-0.089
Farm quantity	0.027	0.028	0.066	0.073	-0.047	-0.029
Retail price	0.154	0.159	-0.077	-0.041	0.020	0.120
Farm price	0.123	0.127	-0.153	-0.124	-0.213	-0.134
Margin	0.186	0.194	0.003	0.047	0.265	0.386
Price*	1.252	1.252	0.504	0.327	0.153	-0.897

Note: Price* stands for price transmission elasticity

Table 1.7: Impact of retail concentration ratio on specific market on quantities, prices, marketing margin and the price transmission.

Parameters	Retail quantity	Farm quantity	Retail price	Farm price	Margin	Price transmission
Scenario 1: $e_K = 0$	0.136	-0.083	-0.184	-0.376	0.017	0.489
Scenario 2: $\lambda_K = 0$	-0.151	0.036	0.203	0.163	0.247	1.253

Chapter 2: Does school enrollment depend on academic performances? Evidence from Alabama public school systems.

2.1 Introduction

Despite significant resources devoted to education in Alabama K-12, school enrollment in many public school systems is facing some significant challenges. Analyzing enrollment in Charter school, Hanushek et al. (2007) suggests a link between academic performances and school enrollment. If this relationship is causal, one might presume that schools would maintain or increase their student performance in order to attract more new students and to remain functional. Yet, data suggest that in many Alabama public school, enrollment is decreasing regularly while others experienced only a relatively small increase in their student population (Alabama department of education, 2014)

The purpose of this study is to determine the impacts of school academic performances and others inherent factors that can potentially influence the variation in schools' enrollment while accounting for the socio-economic factors. Indeed, Kinnucan et al (2006) shows that the reduction of poverty or increasing family income increase student performance that is similar to the impact due to state funding. Thus, provides a ground to test the impact of such factors on enrollment in Alabama public school systems. Previous studies on student populations have shown that school enrollment is mainly affected by the socio-economic factors, namely the level of poverty, income, unemployment as well as migration (Brown and Park 2002; and

Smits and Gündüz 2006). However, recent developments provide a different pattern. In Birmingham area school system, test scores and school enrollment decline concomitantly, leading to a closure of many

schools (Witherspoon 2011); in Hoover, concerned parents have asked the school board to ensure them with an improvement in test scores before deciding to enroll their children (Witherspoon 2011); while Baldwin school system is seeing an increase in students' test scores as well as school enrollment (Alabama Department of Education, 2014), demonstrating that school enrollment in Alabama may not depend only on the socio-economic factors. In fact, parents have demanded for more flexibility to enroll their children in schools which show higher academic performances, leading to the "Alabama Accountability Act of 2013" and suggesting that test scores may have had an impact in parents' decision in enrolling their children in a specific school.

In fact, parent impressions about school quality in predicting school choice matters (Brasington and Hite 2012). Yet, in Alabama, there has been little empirical analysis validating school choice based on academic performances. Parents focus on real target for schooling in that they envision a specific career for their children. In this case, academic performance should be disaggregated to show student performances in specific area (such as test score in math, reading, language etc.…) to reflect parents' true preference. Put it differently, choosing school based on the overall school quality alone would be an increasingly inefficient landmark for action. In addition, for parents to make a reasonable choice with respect to school performances depend on their intellectual capability. Akresh (2007) points out that deciding to enroll a child in school involves considering many variables, including parental beliefs and expectations about the value of schooling. However, these beliefs and expectations are guided by the parent's level of

education (Hunt, 2008). Thus, parents' education level should be considered as students' cultural capital which can guide in the choice of a specific school, given a specific signal. Results of Kunnican et al. (2012)'s study suggesting that the "No Child Left Behind Act" has improved only test scores for 8^{th} grade in language and a test score gains in language between the 4th and 8th grades in Alabama, are examples of such signals.

Study by Ford (2014) suggests that school enrollment increases at higher performing schools, but this increase disappears after controlling for available school-level characteristics. However, by using cross-sectional econometric models based on only one year time period data on test scores, the study does not account for the unobserved heterogeneity across schools. Thus, the estimates of the effect of test scores on enrollment are likely to be biased.

In this study, we aim to estimate a production function based on Hanushek and Raymond (2004)'s framework to analyze the determinants of public school enrollment in Alabama, with a particular attention given to students' test scores. The study uses a panel data covering 128 school systems for the time period 2002 to 2011. The fundamental goal of this empirical analysis is to test the link between test scores and school enrollment. To do this, we include lagged values of test scores as signals to parents in deciding the school choice of their children.

In the next section we review the literature, following by the model used, description of the data and empirical results, which will lead to a concluding remarks and a brief summary of key findings.

2.2 Literature Review

School enrollment has always been among the very fundamental priorities in every successive government in the U.S. and has been a controversial issue. Handa (2002) points out that raising primary school enrollment is easier said than done. The relative importance of school

supply versus households demand factors remains controversial, with serious implication for education policy. Previous studies on the determinants of school enrollment suggest that the fluctuation in enrollment is due both to some extrinsic and intrinsic factors to schools.

Handa (2002) used household's characteristics data and information on school infrastructure to analyze the impact of school characteristics on household's schooling choice. School enrollment decision was measured via a reduced form demand equation for children's schooling. The independent variables of this equation included characteristics of individual household characteristics that capture access to resources (age and sex of the head, education and status of the head of the household) and a vector of school infrastructural characteristics. Marginal probabilities were derived using probit estimation. The sample included children of primary school age (7 to 11 years old) and the dependent variable accounted for whether the child was currently enrolled in school at the time of the survey. The results indicate that education of adult household members seems most important in stimulating child enrollment, although the effects are small and differ by gender. Moreover, the dimensions of school quality, access or availability, and efficiency, all work to stimulate enrollment. Similarly, Kirchsteiger and Sebald (2010) indicated that the education of adults in a household has a significant impact on school enrollment of children in all countries. However, the effect of education of female adults was much larger than that of males in some countries.

Connelly and Zhen (2003) studied the determinants of school enrollment and completion and found that parental education and household income, all affect enrollment level. In addition, the presences of first and second cycle institution in the community are also found to have a significant effect on enrollment. This is because when there is available schools in the area that

can absorb pupils when they graduated from the primary level, parent are also encouraged to enroll them in school.

Huisman and Smit (2009)'s study school enrollment covering 30 countries. The authors studied households and district-level determinants of primary school enrollment using multilevel analysis. The study shows that enrollment were found to be influenced by socioeconomic and demographic characteristics and characteristics of the available educational facilities such as the number of teachers, percentage of female teachers, and distance to school. In addition, Glick & Sahn (2000) found that besides parents' income, occupation and education of the parents also collate to school enrollment. Such results were also obtained when analyzing charter schools [example, Hoxby and Rockoff (2004), Bifulco and Ladd (2006), Sass (2006), Booker et al. (2007), Hoxby and Murarka (2007)].

The results of these studies demonstrate that the socioeconomic factors as well as parental education level are fundamental in enrolling children in school. Perhaps the biggest concern, though, is whether or not less educated parents will be able to choose schools accurately and for academic as opposed to non-academic reasons (Hanushek et al. 2007; Renzulli and Roscigno 2007; Schneider and Buckley 2002; Teske and Reichardt 2006).

Indeed, public school choice based on specific academic achievement is still in its vegetative stage. However, Ford (2014) provides a glimpse on the impact of test scores on enrollment patterns. The author used data on the characteristics of schools participating in the Milwaukee Parental Choice Program (MPCP) to study school enrollment patterns after the first time release of school level test scores. The results of study suggest that even if parents are fleeing low- performing schools in favor of higher performers, the available data after one year of testing does not indicate that test scores in math and reading drive school enrollment.

However, the econometric problem associated with cross-sectional, namely the unobserved heterogeneity across schools in such study cannot guarantee the reliability of its results, thus, justifying this study.

This study is related to the burgeoning literature on the various determinants on school enrollment. Indeed, compared to the large body of the literature which focuses on either the effect of socioeconomic factors or demographic factors as well as some schools' characteristics, the study will put a considerable emphasis on test scores as performance indicator which can impact parents' decision vis-à-vis to school enrollment.

2. 3 Theoretical model

We adopt Hanushek and Raymond (2004) (hereafter "HR") education production function's framework to analyze enrollment in Alabama K-12 public school Systems. Consider HR's simple model in which constant return to scale has not been imposed and represented by equation (1) below:

(1) $O_{ct} = f(X_{ct}, R_{ct}, \rho_c)$

Where O_{ct} is the output level and represented by school enrollment ($ENROL$) in county c in year t, X is a vector of family inputs (household median income (*INC*), unemployment rate (*UNEMPL*) and poverty rate (*POV*)) and non-school inputs represented by the percentage of the population with at least a bachelor degree (*ED*) in county c in year t; and R is a vector of resources, and is epitomized by the average number of full time teachers in a school system (*TEACH*), the total non-instructional expenditure in school system (*NIE*), the proxy of school technology represented by a family of vectors inputs such that the lagged values of the average test score in math (M^{-1}), in reading (R^{-1}) and language (LG^{-1}) as well as previous year school

enrollment (*ENROL*$^{-1}$); and ρ_c is a fixed effect that captures students' reasons to enroll in a school system and other unobserved effects at the school system level.

The vector of family and non-school *X* includes an important production factor, specifically the level of education of the population. In fact, parents' education level is fundamental in the choice of their residency and is also a human capital for their children in deciding to enroll in a specific school system. As such, *X* can be subdivided into two categories of input: X^f is a vector of family inputs (*INC*, *UNEMPL* and *POV*) and h_c represents the non-school input (*ED*).

Following Bils and Klenow (2000), we consider the human capital production function h_t below:

(2) $h_t = \exp [f (\bar{e}_t)]$

Where $\bar{e}_t$ is the average schooling year of the population in the economic system at time t. We normalizing the productivity of illiterate individual to one i.e. f (0) =1, and we assume that

$f'(\bar{e}_t) > 0$.

Based on this, equation (1) can be rewritten as:

(3) $O_{ct} = f(X^f{}_{ct}, h_{ct}, R_{ct}, \rho_c)$

Equation (3) represents the appropriate way to incorporate the level of education into a production function (Hall and Jones 1999; Bils and Klenow, 2000). Taking the logarithm of this equation (3) gives the linear form production function presented in equation (4):

(4) $lnO_{ct} = \beta_0 + \beta_X lnX^f{}_{ct} + \beta_h lnh_{ct} + \beta_R lnR_{ct} + \rho_c + \varepsilon_{ct}$

As before, O_{ct} represents the level of school enrollment in county c in year t; β_0 is the intercept and represents the gain (loss) in school enrollment when the independent variables do not produce any impact; X^f is a vector of family inputs; h_{ct} represents the percentage of educated population ρ_c is a fixed effect that captures students' reasons to enroll and ε_{ct} is an idiosyncratic error.

Replacing h_{ct} by its value from equation (2) into equation (4) gives:

(5) $$lnO_{ct} = \beta_0 + \beta_X lnX^f{}_{ct} + \beta_E f(\bar{e}_{ct}) + \beta_R lnR_{ct} + \rho_s + \varepsilon_{ct}$$

This formalized equation 6 can be used to estimate school enrollment and to test for the impact of test scores. An implicit assumption underlying equation 5 is that school enrollment responds to change in the vector of family inputs and other exogenous variables of the model.

2.4 Empirical model specification

The study focus on public school systems distributed in eight districts (D) representing the State Board of Education of Alabama. We follow Kinnucan et al (2012) and uses test scores for 4th and 8th grade Stanford Achievement Test (SAT) to compute average test scores in each school system as an indicator of school performance affecting school enrollment. Based on equation (5) the empirical model to be estimated is presented as:

(6) $$lnENROL_{ct} = \alpha_0 + \alpha_{EN} ENROL^{-1}{}_{ct} + \alpha_M M^{-1}{}_{ct} + \alpha_R R^{-1}{}_{ct} + \alpha_L LG^{-1}{}_{ct} +$$
$$\alpha_{DM} D_i * M^{-1}{}_{ct} + \alpha_{DR} D_i * R^{-1}{}_{ct} + \alpha_{DL} D_i * LG^{-1}{}_{ct} + \alpha_T TEACH_{st} + \alpha_N NIE_{st} +$$
$$\alpha_E ED_{ct} + \alpha_I INC_{ct} + \alpha_U UNEMPL_{ct} + \alpha_P POV_{ct} + \rho_c + \varepsilon_{ct}$$

where α_{EN}, α_M, α_R, α_L, α_{DM}, α_{DR}, α_{DL}, α_T, α_N, α_E and $\alpha_I > 0$ and α_U and $\alpha_P < 0$

The coefficients on the independent variable of equations (6) are elasticities and are interpreted as percentage change. The model includes schools' test scores and allow testing if academic performance in a specific course has a significant impact on enrollment; while including the interaction terms between test scores and the dummy variable district (*D*) permits to test the impact of academic performance across districts on enrollment.

Equation 6 allows estimating enrollment at state level. However, by dropping the interaction terms, it can be used to estimate enrollment at city school systems/county school systems.

Indeed, test scores in city school system are much higher compared with its county counterpart. Hence, making it tempting to conclude that based on academic performance criteria city school systems would see a significant increase in enrollment compared to county school systems.

Figures 2.1 – 2.2 in appendix 2 show the evolution of test scores in city and county school systems. Figure 2.1 shows that in city school systems, test scores in math are generally higher compared to test scores in language and reading. In fact, students' performances start to decline after 2007. During that period, students' performances in language start grow and reach the level of their performances in math. In county school systems however, figure 2.2 indicates that students perform better in language than in math and reading. In fact, after year 2005, test scores in math start to increase from 49 percentile to reach 53 in 2010 while test scores in reading grow from 47 percentile to 51 percentile. However, these performances do not equate to the level of achievement in language produce by students.

Figures 1-2 also show that school enrollment in both school systems (city/county) increase and decrease in the same fashion, with county school enrollment far larger than city enrollment. Nevertheless, this higher enrollment in county school systems compared to city school systems does not suggest a superior education quality in county school systems to trigger a movement from city school systems to county school system. In fact, county school systems are in general larger compared to city school systems.

Current school enrollment is a function of school enrollment from previous years, given the reputation of the school. Furthermore, schools may have some strong, unobserved effects on students attending them. Since these factors are unobserved, they are not included in the regression models. In this respect, they would possibly bias the estimates if being done by OLS.

To control for the possibility that schools have different unobserved effects, we make the assumption that all these unobserved factors are fixed at least during the period of the study.

Equations (6) show that the dependent variable *(ENROL*) depends on its own past realization. In this case, $ENROL^{-1}$ is correlated with the error term. Consequently, a fixed effects model, a random-effects model or the maximum likelihood estimator usually applied to static panel data models are all inconsistent (Anderson and Hsiao 1981; Arellano and Bond 1991). Taking the first difference of the equation, Anderson and Hsiao (1981) suggest a consistent estimator using $\Delta lnENROL^{-1}$ (= $\Delta lnENROL^{-2}$ - $\Delta lnENROL^{-3}$) as instrumental variables.

In fact, lagged endogenous variable, three or more time periods before, can be used as instruments (Holtz-Eakin et al., 1988). However, Arellano and Bond (1991) and Judson and Owen (1996) point out that the Anderson-Hsiao estimator is inefficient because it does not take into account all the variable moment restrictions, and thus the performance of the estimator is very poor when the sample size is small. Consequently, Arellano and Bond (1991) and Arellano and Bover (1995) suggest a Generalized Method of Moments (GMM) estimator known to be consistent, asymptotically normal and more efficient because it uses additional instruments whose validity is based on the orthogonality between lagged values of the dependent variable and the error term ε_{ct}. Following Arellano-Bond, this study adopts the two steps GMM as a method of estimation of school enrollment and is performed using SAS 9.3 software.

2.5 Data

Panel dataset used ranges from the time period 2002 to 2011, and combines data on socioeconomic factors as well school resources and academic performances covering all Alabama's public school systems. The state is composed by 67 county school systems and 61

city school systems. Mobile County is the largest system while Linden city is the smallest system.

The main variable or output of the study, school enrollment (ENROL) is obtained from various annual reports/education report cards of the Alabama State Department of Education (ALSDE) where it is termed as the "average daily membership" (ADM) and is recorded being K-12 attendance average used to quantify the yearly enrollment, and $ENROL^{-1}$ represents its lagged value.

The variable non-instructional expenditure (NIE) is computed as the difference between the total expenditure and instructional expenditure of the school system. Instructional expenditure is the sum of expenditure on instructional service and instructional support. Like the variable ENROL, expenditure on instructional services, expenditure on instructional support and total expenditure are all extracted from the annual reports of the ALSDE. NIE is then deflated using consumer price indexes (CPI) from the Bureau of Labor Statistics (BLS), using the year 1982-1984 as a base value.

Adult education attainment (ED) is defined as the percentage of persons aged 25 and over with at least a bachelor degree. It is extracted from various County-level Education Data for Alabama by the US Department of Agriculture. The Economic Research Service (ERS) of the US Department of Agriculture compiled the table on education attainment based on the results of U.S. Census.

M8, LG8, R8, M4, LG4, R4 are the eighth and fourth grade Stanford Achievement Test (SAT) scores in math, language and reading respectively. They are extracted from the assessment reporting system of the Alabama state department of education. Test scores for the school system in math (M), language (LG) and reading (R) are the average test scores for the

fourth and eighth graders. Test scores from 2002 are the Stanford Achievement Test Scores, called *Stanford 9* and are based on 1995 norms, contrary to the *Stanford 10* which covers the time period 2003-2011 and which are based on the 2002 norms. We then use the Harcourt assessment percentile rank conversion table for *Stanford 9* to *Stanford 10* offered by the test provider to make test scores of the two Stanford editions comparable. Consequently, all test scores in the analysis are converted to *Stanford 10* percentiles.

The variables POV and INC are obtained from the U.S Census Bureau. POV is defined as the percentage of children of ages 5-17 per county in poverty relative to the counties children of the same age. INC is the median family income per county per year and is deflated following the same procedure used to deflate "NIE".

UNEMP is the annual averages unemployment rate at the county level. It is obtained from the U.S Bureau of Labor Statistics (BLS). Finally, TEACH represents the number of full time equivalent teacher. It is gathered on a school system basis from the National Center for Education Statistics and was then divided by the number of schools within the school system to produce the average number of full time equivalent teachers per school system. Details on the variables of the estimation and the summary statistics are displayed in table 2.1.

2.6 Methods of estimation

The theoretical argument is strong for treating some variables of the models as endogenous when employed as regressors. Nevertheless, to be consistent with the requirement for instrumental variables used in GMM, Hausman specification tests were performed to test for endogeneity of the variables of the models. The results of the tests using a 5 percent level of confidence suggest that the variables NIE, TPAY, TEACH and PPS are endogenous.

Based on these results, the instrumental variables used in the models are as follows: a) the lagged values of NIE, TPAY, TEACH, PPS, M, R, LG and the dependent variable; b) current values of the remaining variables (POV, INC, ENROL, UNEMPL and EDU), providing a total number of instruments of 13, three more than the minimum number required when using GMM.

The validity of the instruments was tested following Sargan test for over-identifying restrictions. Table 2.3 shows a chi-square value of 1.73 with a P-value of 0.121, which suggest that we cannot reject the hypothesis that the over-identification restrictions are valid. Finally, The GMM estimation is conditional on the assumption that the error terms are not serially correlated. To fulfill this assumption, we applied the test for autocorrelation using Arellano-Bond autocorrelation test.

The results of the tests indicate a chi-square of value of -2.72 with a p-value of 0.996 for the model at the state level. Thus, the result presents no evidence of serial correlation. Similar results were obtained when estimated based on city/county school systems.

We test the validity of the dynamic model specification and three hypotheses which are rooted in the belief that when given the ability to choose, parents will move their children to high-quality schools. Friedman (1955) suggested that parents will act as rational consumers and avoid lower performing schools. Then the fundamental hypotheses to be tested are:

Hypothesis 1 (H1): The coefficient of lagged dependent variable (ENROL^{-1}) is zero. This hypothesis explicitly suggests the adequacy of the static model over the dynamic model specification.

Hypothesis 2 (H2): The coefficients of the independents variables test scores are jointly equal. This implies that test scores (math, reading and language) have the same impact on the relative change in school enrollment.

Hypothesis 3 (H3): The coefficients of the independents variables test scores across districts are equal. This suggests that district test scores (in math, reading and language) have the same impact on the relative change in enrollment.

The logic of hypotheses 3 is similar to hypotheses 2, only, with the advantage of considering district academic performances on enrollment growth trends. Considering enrollment growth at district level addresses a potential weakness of hypothesis 2. However, if both hypotheses 2 and 3 are found to have merit, the case for a relationship between test score and enrollment changes will become stronger.

Hypotheses 1 involves just one restriction and therefore is tested using a simple t-test statistic. On the other side, hypothesis 2 and hypothesis 3 involves three and eight restrictions respectively. They are tested using the Wald test.

2.7 Results

Results displayed in table 2.2 show that hypothesis 1 is rejected at $p < 0.05$ level of significance. Hence, the dynamic specification model is appropriate. Similarly, Hypothesis 2 is rejected with no probability of a Type I error ($p < 0.0001$) indicating that the impact of test scores on enrollment differ across courses; while hypothesis 3 is rejected at $p < 0.05$ in all cases ($p = 0.001$ in the case of district test scores in reading, $p = 0.006$ for district test scores in math and $p < 0.0001$ for the case of district test scores in language), suggests the impacts of test scores in math, reading and language on enrollment differ across districts.

Results of the empirical analysis displayed in table 2.3 provide a strong evidence of the link between school academic performance and school enrollment. This suggests that parents' decision to enroll their children in a specific school is based upon schools' academic performances. In fact, after accounting for the socio-economic factors (POV, INC, UNEMPL)

and other factors that are inherent to schools ($ENROL^{-1}$, TEACH, NIE), test score in math (M), reading (R) and language (L), all have significantly increase the level of school enrollment. In particular, the results show that a 10 percent increase in test score in math, reading and language raises the level of enrollment by 1.23 percent, 0.28 percent and 0.65 percent respectively. Thus, contradicting the findings obtained by Ford (2014), and suggests that academic performances and school choice are intimately linked.

Findings display in table 2.3 also shows that some of the conventional variables of the model (INC, POV, NIE, EDU, TEACH, and $ENROL^{-1}$) affect enrollment significantly. In one side, the estimated coefficients on the variables POV and INC are statistically negative. In particular, the results show that increase in poverty rate by 10 percent decreases school enrollment by about 0.30 percent. In fact, in Alabama, the parental responsibilities in Section 16-28-12, Act 94 require children between the ages of 7-16 to attend school (ALSDE, 2014). The law also states that parents or guardians having control over school age children are responsible for the children's regular attendance and proper conduct. Consequently, the observed decrease in enrollment may reflect the case in which, as the level of poverty increases, many families have left the state in search for a better life conditions. Similarly, the results also suggest that as the family median income (INC) increases, enrollment in public schools decreases. This implies that the increase in family income is large enough to trigger an emigration from public schools towards private schools. In this case, children from high income families are more likely to attend private schools, leaving public schools to children from low income families.

The results however, indicate that ED, NIE, TEACH and $ENROL^{-1}$ all increase enrollment significantly. School enrollment increases by 0.26 percent, 0.12 percent, 1.01 percent and 4.24 percent as ED, NIE, TEACH and $ENROL^{-1}$ increase by 10 percent respectively. The

positive impacts of TEACH and NIE on enrollment reinforce the very fundamental idea which suggests that "money matters" in education output; while the findings which indicate that previous year enrollment ($ENROL^{-1}$) has a significantly positive impact of current year enrollment (ENROL) can be explained by the reputation of the school in the community. In fact, if previous year students and their parents do not have particular griefs with the school system, they become "ambassadors" of that school system. Consequently, students' parents can convince their friends, neighbors, and people in their communities to enroll their children in the same school as theirs, and could potentially contribute to increase in enrollment.

With respect to UNEMPL, the results show that it does not have a significant impact on school enrollment. In fact, not all unemployed individuals are poor. In this case, the number of unemployed families who fall into "poor individuals" category and who left the state is not high enough to significantly impact the number of children enrolled in the state public school systems.

Results in table 2.3 also show that the impacts of the independent variables on enrollment at city school systems are similar to those observed at the state level. Test scores in math, reading and language, all have a significant positive impact on enrollment. Enrollment increases by 0.5 percent, 0.2 percent and 1.1 percent when test scores in math, reading and language increase by 10 percent respectively. In county school systems however, only test scores in language produces a significantly positive impact on enrollment. In fact, the magnitude of the impact on enrollment is very close to that on enrollment in city school systems as a result of an increase test scores in language. Specifically, enrollment increase by 1.2 percent as a result of 10 percent increase in students' performances in language. In city school systems as well as county school systems, increase in family income and increase in the poverty rate is followed by a decline in enrollment

while increase in unemployment has a significantly negative impact only at county school system level.

A look at table 2.4 shows that given the level of significance level of 5 percent, test scores in reading increases enrollment only in D5 and D8. Enrollment increases by 0.25 and 0.48 percent as test scores in reading in D5 and D8 increase by 10 percent respectively. The decrease in enrollment is observed with test scores in D1 and D3. However, this decrease is not statistically significant (at $p = 0.05$). With respect to Math, test scores in D2, D3, D7 and D8 increase enrollment significantly; while test scores in language in most districts have a significant impact on enrollment except in D1, D4 and D8. The largest enrollments are obtained with test scores in D2 and are followed by D3 and D5. In particular, an increase in the district test scores in language by 10 percent lead to an increase in school enrollment by 31.3 percent, 1.68 percent and 1.64 percent for test scores in language in D2, D3 and D5 respectively.

2.8 Concluding Remarks

Raising school enrollment has always been a major development imperative. However, remains a challenging problem. The state of Alabama, although has put in place policies that can best raise school enrollment, other factors play a key role in stimulating its growth. Using data on test scores, coupled with information that are inherent to all Alabama public school systems as well as data on the socio-economic factors, the paper estimates a production function based model in determining enrollment growth in public school systems.

Simulations based on a set of “plausible” production functions indicate that in Alabama public school systems, increasing school academic performances, increasing the number of full time teachers and increasing school funding have a larger impact on enrollment growth than increasing interventions that raise household income. The study suggests that increase in test

scores in reading, math and language, all increase enrollment growth. However, the results indicate that test scores in math produce the largest impact. For example, an increase in test scores in math by 10 percent lead to an increase in enrollment by about 1.23 percent compared to its value obtained under test scores in language (0.65 percent) and reading (0.3 percent). This suggests that parents have a particular preference for schools producing a higher performance in math. The impact of test scores in language on enrollment growth is much larger compared to the impact of test scores in reading, and this is understandable in the context of Alabama where for many years, the "No Child Left Behind Act" has contributed to increase only test scores in language but not for math and reading.

A comparative analysis between city and county school systems however, indicates that test scores in math, reading and language increase the rate in enrollment city school systems whereas at county school system level, only test scores in language produce a significant positive impact.

The results of the study also suggest that the link between specific academic performances and school enrollment varies depending on the school location. A detailed analysis on the impact of district test scores on school enrollment indicates that test scores in language in all the districts except in district D1, D4 and D8 improve enrollment; test in math scores increase enrollment in district D2, D3, D7 and D8; while test scores in reading raise enrollment only in district D5 and D8. Furthermore, the study shows that some the conventional variables such as INC and POV decrease enrollment significantly while ED, TEACH and $ENROL^{-1}$ produce a positive impact.

Table 2.1: Summary statistic for variables used in the model (*number of observation* =1280)

Variable	Definition	Mean	SD	Min	Max
R	State average test score in Reading, national percentile	51.7	11.3	18	89
M	State average test score in Math, national percentile	56.1	11.8	29	92
LG	State average test score in Language, national percentile	56.3	10.1	26	90
ENROL	School district size, average daily membership	5,719.	8,050.	473	65,315
INC	Median family income, 1982-84 dollars	21,357	4,239	11,077	43,088
PPS	Per pupil spending, 1982-84 dollars	3,792	569.0	3,157	6,036
TPAY	Annual teacher pay, 1982-84 dollars	22,965	904	20,879	26,876
POV	Poverty rate, percent	24.4	6.8	7	54
UNEMP	County unemployment rate, percent	6.7	3.2	2	24
TEACH	School system, number of full time teacher	56.9	29.9	18	206
ED	Adults 25 and older with at least a Bachelor's degree, percent	16.4	7.2	5	45
NIE	School system non instructional expenditure, 1982-1984 dollars, millions	11.791	18.824	0. 937	190.744
D1	State Board of Education District 1	0.03	0.17	0	1
D2	State Board of Education District 2	0.20	0.40	0	1
D3	State Board of Education District 3	0.13	0.34	0	1
D4	State Board of Education District 4	0.11	0.31	0	1
D5	State Board of Education District 5	0.20	0.40	0	1
D6	State Board of Education District 6	0.09	0.28	0	1
D7	State Board of Education District 7	0.15	0.36	0	1
D8	State Board of Education District 8	0.09	0.29	0	1

Table 2.2: Results of hypothesis tests

Model	**H1** H_0: Static Model		**H2 and H3** H_0: test scores have the same effects on the change on enrollment	
	t-statistic	P-value	Chi-square	P-value
Equation 6	31.13	< 0.0001	49.25	< 0.0001
Equation 6^R			23.47	0.001
Equation 6^M			19.76	0.006
Equation 6^L			57.80	< 0.0001

^{R}: Equation is used to test the impact of district test scores in reading on school enrollment
^{M}: Equation is used to test the impact of district test scores in math on school enrollment
^{L}: Equation is used to test the impact of district test scores in language on school enrollment

Table 2.3: Impact of test scores and socio-economic factors on school enrollment

Variable / Statistic	State school systems		City school systems		County school systems	
	Coefficient	t-ratio	Coefficient	t-ratio	Coefficient	t-ratio
C	-0.005	-3.77	0.000	0.04	-0.005	-4.53
lnR^{-1}	0.028	2.79	0.019	3.82	-0.065	-0.86
lnM^{-1}	0.123	10.02	0.048	5.77	0.000	0.02
$lnLG^{-1}$	0.065	3.97	0.107	12.25	0.118	7.9
$lnEnrol^{-1}$	0.424	16.35	0.553	15.62	0.575	20.95
lnINC	-0.07	-2.38	-0.110	-4.2	-0.065	-2.17
lnPOV	-0.03	-4.47	-0.015	-5.03	-0.017	-1.77
lnUNEMPL	-0.004	-1.52	-0.003	-1.25	-0.006	-2.85
ED	0.026	9.05	0.007	3.31	0.029	14.62
lnNIE	0.012	3.25	0.019	7.94	0.004	1.43
lnTEACH	0.101	7.34	0.082	7.29	0.066	4.69
	Chi-squared	P-value	Chi-squared	P-value	Chi-squared	P-value
Sargan Statistic	1.73	0.12	3.41	0.93	2.24	0.94
Arellano-Bond AR(1) statistic	-2.72	0.99	-1.86	0.74	-2.59	0.85

Table 2.4[a]: Impact of district test scores on school enrollment

Region/statistic	READING		MATH		LANGUAGE	
	Coefficient	t-ratio	Coefficient	t- ratio	Coefficient	t- ratio
D1	-0.194	-1.78	-0.0094	-0.34	0.129	1.33
D2	0.002	0.11	0.056	2.25	3.13	2.88
D3	-0.028	-1.45	0.098	3.13	0.168	8.02
D4	0.007	0.42	-0.008	-0.41	0.049	1.81
D5	0.025	2.00	-0.022	-0.94	0.164	5.35
D6	0.007	0.44	0.079	1.21	0.095	3.12
D7	0.011	0.88	0.051	1.93	0.036	2.24
D8	0.048	3.39	0.095	2.23	-0.046	-0.59
			Chi-square		P-value	
Sargan Statistic			1.73		0.121	
Arellano-Bond AR(1) statistic			2.72		0.996	

[a]: Selected results of model equation 6

Chapter 3: Economic Analysis of the Effects of the United Nations Convention against Corruption (UNCAC) on the level of Corruption and per-capita GDP: Evidence from the Sub-Sahara Africa (SSA)

3.1 Introduction

Economists, political scientists, international agencies such as the International Monetary Fund and the World Bank, all agree on the nefarious cost associated with corruption. Thus, reject the veracity of the "efficient grease" hypothesis. In fact, the very fundamental argument developed by Leff (1964) and Huntington (1968) in support of the hypothesis is that corruption enhances efficiency in the economy, where bribery serves as a lubricant that reduces delays and transaction costs and thus leads to growth. However, recent academic works provide a ground for the rejection of such hypothesis. Studies by Shleifer and Vishny (1993), Mauro (1995 and 1997), Kaufman and Wei (1999), Blackburn and Sarmah (2008), Blackburn and Haque (2009), Aidt (2009), Nageri et al. (2013) and Egunjopi (2013), all demonstrate that corruption has a detrimental impact on economic growth.

The purpose of this study is to determine the effects of the United Nations anti-corruption law (UNCAC) nine years after its implementation on the level of corruption and per-capita GDP in the SSA, after accounting for "Freedom" (economic freedom). Corruption is well spread around the world. However, its level and its consequences are quite severe in the developing world including SSA. In Kenya, 250,000 jobs are lost to corruption annually (World Bank 2012);

while quoting the African Union, Ndiva (2006) suggests that 25 percent of the gross domestic products (GDP) of African countries are lost to corruption every year. This massive financial hemorrhage has certainly prevented investment in various economic sectors, exacerbating the prevalent problem of poverty, economic growth and economic development.

Tackling a problem with such scale necessitates a concerted effort of the international community. Thus, justifying the United Nations Convention against Corruption (UNCAC) ratified in 2003, but which entered into force only in December 2005. Built on a global consensus, UNCAC becomes the first instrumental economic policy which aims to prevent and to combat corruption. In fact, through its provisions (Article 1), in particular, those concerning the areas of prevention, criminalization, and asset recovery, countries related on their law enforcement and international corroboration to treat the most serious forms of corruption as crimes against humanity and should be prosecuted in the highest national and international courts (GOPAC, 2013).

During the last decades, populations around the world are well aware of the consequences associated with corruption. However, when it is widespread, individuals do not have incentives to fight it even if everybody would be better off without it (Mauro, 2004). Consequently, corruption per worker has a negative effect on output per worker directly and also indirectly on foreign private investment, expenditure on education, capital expenditure per worker and per capita gross domestic product (Egunjobi 2013; Nageri et al., 2013; Asiedu and Freeman 2009), leading Nageri et al. (2013) to recommend a strict application of anti-corruption codes. However, such recommendation could be quite misleading if the impacts of UNCAC on the variables of interest or its impacts on the corruption itself is not statistically tested. In fact, almost a decade after the implementation of UNCAC, the literature on the economics of corruption offers little if

not none empirical study testing the impact of such policy on the level of corruption it aims to eradicate nor its effects on the GDP in which it wants to prevent further losses.

This study analyses the impact of the United Nations anti-corruption law as well as the effects of economic freedom on the level of corruption and per capita GDP. The main goal is to answer to the question of whether the United Nations anti-corruption law has helped reducing the level of corruption and increasing per-capita GDP in the SSA. Thus, makes the study one of the first to empirically test the effectiveness of the policy.

3.2 Literature Review

Previous economics of corruption studies offer a convoluted and yet passionate explanation of the impact of corruption on economic growth and economic development. In fact, the theoretical work on the link between corruption and economic performance dates back to the 1960s. Starting with Leff (1964) and Huntington (1968), various authors have indicated that corruption might have a positive impact on output, mainly through two sets of procedures:

- The "speed money" which allows individual to escape longer bureaucratic delay, and
- The "piece rate" which suggests that government agents who are given authorization to levy bribes would perform their duty more diligently.

Although the first procedure would certainly raise the prospect that corruption would be suitable to economic growth only in countries where bureaucratic regulations are ponderous, the second procedure would operate regardless of the level of red tape (Mauro, 1995). The existence and or the coexistence of these two procedures suggest a conceptualized corruption.

Recent economic problems associated with corruption in various Transition countries and developing countries, lead to a number of serious inquiries that scientific research have to address, in particular, the definition and measure of corruption, the consequences of corruption

on output as well as the sphere and efficiency of anti-corruption policies (Svensson 2005). In fact, in today world, very few people would have the courage to suggest that corruption is efficient.

In his attempt to shift the focus of corruption to the macroeconomic level, Mauro (1995) estimate the impact of corruption on economic growth. The author assembled a dataset consisting of subjective indices of corruption, the amount of red tape, the efficiency of the judicial system, and various categories of political stability for a cross section of countries. Whilst the results of his work did not produce a significant link between corruption and growth, the author find a significant relationship between bureaucratic efficiency and growth. Notwithstanding, using a larger data set, Mauro (1997) indicated that the impact of corruption on per capita income growth rates and investment was negative and statistically significant. A one-standard-deviation in improvement in the control of corruption is found to be associated with a 0.5 percentage point increase in the annual per capita income growth and 4 percentage point increase in investment rate. Mauro's findings' were later validated by Mo (2001), Méon and Sekkat (2005) and Podobnik (2008), who indicate that corruption is prejudicial to economic growth and economic development.

Indeed, the freshly emerging work on the impact of corruption on various economic indicators has been captured by Wei (1999), who reviews a staggering number of empirical works and offers new evidence on the link between corruption and growth. Wei's study suggests that the higher the level of corruption in a country, the poorer the country's economic performance is. The detrimental effects of corruption on economic growth and development are reported to result from reduced domestic investment, overspending in government and distorted composition of government spending and discouraged foreign direct investment (FDI).

Subsequently, the author discusses numerous policy options, including paying civil servants a competitive salary in relation to similar jobs in the private sector; merit-based recruitment and promotion of civil servants; reforming the government's role in the economy; and international pressure on countries with high levels of corruption.

Wei (2000a) estimates the impacts of corruption and taxation on FDI using bilateral FDI flow. The sample data covers bilateral investment from 12 source countries to 45 host countries. Using three different measures of corruption, the results suggest two key findings: an increase in either the tax rate on multinational firms or the level of corruption in the host countries would reduce inward FDI; and in a benchmark estimation, an increase in the level of corruption from that of Singapore to that of Mexico would have the same negative effect on inward FDI as raising the tax rate by 50 percentage points. In another study also employing survey data on countries' investment environments, Wei (2000b) also examines corruption's effects on the composition of capital flows using bilateral capital flow data from 14 source countries to 53 host countries. His findings suggest that there is indeed a negative relationship between corruption and FDI and that the reduction in FDI caused by corruption is greater than the negative impact of corruption on other types of capital inflows. He finds that corrupt host country tends to receive less FDI relative to portfolio capital and bank loans.

Abed and Davoodi (2000) use a panel data analysis to test the effects of levels of corruption on per capita FDI inflows to Transition economies. They find that countries with a low level of corruption attract more per capita FDI. However, once they control for the structural reform factor, corruption becomes insignificant. They conclude that structural reform is more important than reducing the level of corruption in attracting FDI.

Smarzynska and Wei (2002) use a firm-level data set from transition economies to estimate the impacts of corruption in terms of firms' decision not to enter a particular market, rather than in terms of reduced bilateral investment flows. Their results indicate that FDI entry strategy in a corrupt host country is to enter into joint ventures with a domestic partner to save the transaction costs of dealing with local government officials rather than to establish an entirely owned subsidiary.

Voyer and Beamish (2004) use cross-sectional regressions to estimate the effects of the level of corruption on Japanese FDI in 59 (developed and emerging) host countries. They find that Japanese FDI is negatively related to the level of corruption especially in emerging countries. Furthermore, their results show that in emerging countries where a comprehensive legal system is underdeveloped or does not exist to effectively reduce illegal activities, corruption serves to reduce Japanese FDI inflows.

Several other authors who studied corruption have concluded that corruption has detrimental impacts on the growth and development of any nation. According to Nageri et al. (2013), Ekpo and Egenedo (1985), Obadan (2002) and Adewale (2011), corrupt practices inherently introduce distortions in the economic system; it impairs hard work, diligence and efficiency. It is capable of diverting resources meant for the development of the society to private or personal use; and is detrimental to promote the growth of per capita income per annum. They maintain that corruption does not give room for honest selection processes and also distort prices. In fact Nageri et al. (2013) went even further to recommend that governments employ the strict application of anti-corruption codes as stipulated in the legislations that created the anti-corruption agency without prejudice or double standard irrespective of the culprit's stature or position in the society. These are some strong recommendations and yes very important if

countries are serious about minimizing the impacts of corruption on economic growth and economic development. However, such recommendations without testing the impact of the anti-corruption policy, which is put in place by the United Nations and implemented in almost all countries, would be quite misleading.

3.3. 1 *Theoretical Model*

We adopt a modified version of Cebula et al. (2013)'s growth model and Podobnik et al. (2008)'s model of corruption. In doing so, the study takes into account the bi-directional relationship between the two main variables (per capita GDP and corruption) of the study. The growth model specification is represented by equation (1) while equation (2) stands for corruption model.

The very fundamental difference between this theoretical model of corruption and the previous model is that this model includes the variable anti-corruption policy. The structural model may be expressed in general functional form as follows:

(1) $Y = Y(C, \bar{F})$ $\quad \frac{\partial Y}{\partial C} > 0, \ \frac{\partial Y}{\partial \bar{F}} > 0$

(2) $CPIN = C(Y, \bar{P})$ $\quad \frac{\partial C}{\partial Y} > 0, \ \frac{\partial C}{\partial \bar{P}} > 0$

Where Y is per-capita GDP, $CPIN$ the corruption perception index (higher values indicate lower levels of corruption), $\bar{F}$ is an economic freedom index (higher values indicate greater freedom) and $\bar{P}$ is a policy variable designed to reduce corruption (e.g., UNCAC). The model consists of two endogenous variables, Y and $CPIN$, and two exogenous variables, $\bar{F}$ and $\bar{P}$. Other variables that shift equations (1) and (2), such as bi-lateral relationships between the USA and SSA countries, are suppressed.

In this model, economic growth is assumed to be positively related to corruption perception index (decreases the level of corruption increase economic growth) and economic

freedom, while corruption perception index is assumed to be positively related to economic growth and anti-corruption measures (Higher income countries have less corruption, *ceteris paribus*, and anti-corruption measures such as UNCAC are effective.)

With these assumptions, what can be deduced about the effects of the policy variable $\bar{P}$ on Y and $CPIN$? To answer the question, we first express the structural equations in relative change form to yield:

(3) $Y^* = \alpha_C CPIN^* + \alpha_F \bar{F}^* \qquad \alpha_C > 0,\ \alpha_F > 0$

(4) $CPIN^* = \beta_Y Y^* + \beta_P \bar{P}^* \qquad \beta_Y > 0,\ \beta_P > 0$

Where the asterisk indicates relative change (e.g., $Y^* = dY/Y$) and the Greek symbols are elasticities. Solving equations (3) and (4) for Y^* and $CPIN^*$ in terms of the exogenous variables yields the reduced form followed:

(5) $Y^* = \frac{\alpha_C \beta_P}{1-\alpha_C \beta_Y}\ \bar{P}^* + \frac{\alpha_F}{1-\alpha_C \beta_Y}\ \bar{F}^*$

(6) $CPIN^* = \frac{\beta_P}{1-\alpha_C \beta_Y}\ \bar{P}^* + \frac{\alpha_F \beta_Y}{1-\alpha_C \beta_Y}\ \bar{F}^*$

The effect of anti-corruption policy on economic growth is indeterminate without further restrictions on model parameters. One such restriction is to assume that the relationship between Y^* and $CPIN^*$ is inelastic, as suggested by the empirical analysis of Podobnik et al. (2008). In this instance, $0 < \alpha_C \beta_Y < 1$, and the model yields four hypotheses as follows:

(H1) $\frac{Y^*}{\bar{P}^*} = \frac{\alpha_C \beta_P}{1-\alpha_C \beta_Y} > 0$ (H2) $\frac{Y^*}{\bar{F}^*} = \frac{\alpha_F}{1-\alpha_C \beta_Y} > 0$

(H3) $\frac{CPIN^*}{\bar{P}^*} = \frac{\beta_P}{1-\alpha_C \beta_Y} > 0$ (H4) $\frac{CPIN^*}{\bar{F}^*} = \frac{\alpha_F \beta_Y}{1-\alpha_C \beta_Y} > 0.$

Anti-corruption policy increases the corruption perception index (thus reduces the level corruption) and increases economic growth *provided Y is sufficiently unresponsive to* $CPIN$ *or* $CPIN$ *is sufficiently unresponsive to* Y *such that* $0 < \alpha_C \beta_Y < 1$.

The foregoing suggests the following empirical approach: estimate equations (3) and (4) (augmented to include other shift variables) and test the hypothesis

(7) $H_N: \alpha_C \beta_Y \geq 1$

$H_A: \alpha_C \beta_Y < 1.$

Rejection of H_N would constitute evidence in favor of the hypothesis that UNCAC had a positive effect on economic growth in SSA. This, of course, presupposes that $\alpha_C > 0$ and $\beta_P > 0$, which would need to be tested first.

3.3.2 *Empirical specification and estimation procedures*

Simultaneous equation model with panel data is used to test the impact of UNCAC on the level of corruption and per capita GDP growth in 20 SSA countries. The corruption perception index (CPIN) which generally defines corruption as "the misuse of public power for private benefit" is used as an indicator of the level of corruption. How corrupt a country public sector is perceived to be is based on the CPIN (Transparency International, 2014).

The CPIN scores vary from 0 for highly corrupt to 10 for very clean countries. The study covers countries in SSA countries exclusive of countries which do not participate at least in the 1999 compilation and publication of the index.

We augment equations (3) and (4) by including additional variables (DCP, FDI, EX, IMP and UNEMPL) to get model equations (8) and (9) as presented below.

(8) $GDPCP_{jt}^{*} = \alpha_0 + \alpha_C CPIN_{jt}^{*} + \alpha_F FREEDOM_{jt}^{*} + \alpha_{DC} DCP_{jt}^{*} + \alpha_{DF} FDI_{jt}^{*} + \alpha_{EX} EX_{jt}^{*} + \alpha_{IM} IMP_{jt}^{*} + \zeta_j + \epsilon_{jt}$

(9) $CPIN_{jt}^{*} = \beta_0 + \beta_G GDPCP_{jt}^{*} + \beta_U UNEMPL_{jt}^{*} + \beta_{UNC} UNCAC_t + \sum_{i=1}^{4} \beta_{UNR} RG_{it} * UNCAC_t + \zeta'_J + \epsilon'_{Jt}$

Where i = 1…4

$GDPCP_{jt}$ is per-capita gross domestic product of a SSA country j in year t and is measured in real U.S. dollars; $CPIN_{jt}$ represents the Corruption Perception Index in country j in year t; FREEDOM is the overall economic freedom index; DCP is the domestic credit to private sector; FDI is the foreign direct investment; EX represents export of goods and services; IMP stands for import of goods and services; UNEMPL is the rate of unemployment; UNCAC is the variable representing the United Nations anti-corruption policy and is modeled using a dummy variable that takes the value of 0 for the period pre-UNCAC (1999-2005) and the value of 1 for the period post implementation of UNCAC (2006-2014); and RG is a dummy variable representing the geographical location (Middle Africa = RG1; East Africa = RG2; Southern Africa = RG3; and West Africa = RG4), and captures the cultural norm in the region. An interaction between the dummy variable UNCAC and the dummy variable RG is created to test if the impacts UNCAC differ across SSA regions. ζ_j and ζ'_j are the fixed effect that captures the policy and unobserved effects at the country level; and ϵ_{jt} and ϵ'_{jt} are idiosyncratic error terms.

The model equations are in logarithm form specification to allow the estimated coefficients to be interpreted as elasticities. Equation (8) suggests that per capita GDP in a country responds to the level of corruption in that country as well as the country overall economic freedom, foreign direct investment, domestic credit to private sector, export and import of goods and services; while equation (9) indicates that the level of corruption depends on the transparency and accountability by the government (UNCAC), per capita GDP, the rate of unemployment as well as the cultural norm in the region.

The model has two endogenous variables (GDP and CORR) and 8 exogenous variables (FREEDOM, DCP, FDI, EX, IMP, UNEMPL, UNCAC and REG) and provide a ground to test the impact of UNCAC across SSA's geographical location, namely:

H5: The coefficients of the interaction terms involving UNCAC are jointly zero. This hypothesis suggests the effect of UNCA is uniform across the SSA regions.

By the order and rank conditions for identification, the model equations (8) and (9) are over-identified. The correlation between the fixed effects (ζ_j and ζ'_j) and the explanatory variables will cause biases in the estimated coefficients. However, as suggested by Hsiao (1986, 2003), this problem can be eliminated through a within transformation (time demeaning) of the variables. Demeaning over time eliminates ζ_j and ζ'_j.

Solving the demeaned form of equations (8) and (9) for $GDPCP^*$ and $CPIN^*$ in term of the exogenous variables of the model yields the reduced form equations (10) and (11):

(10) $$\text{gdpcp}_{jt}^{*} = \pi_0 + \pi_F \text{freedom}^{*} + \pi_{DC}\text{dcp}_{jt}^{*} + \pi_{DF}\text{fdi}_{jt}^{*} + \pi_{EX}\text{ex}_{jt}^{*} + \pi_{imp}\text{imp}_{jt}^{*} + \pi_U \text{unempl}_{jt}^{*} + \pi_{UNCAC}\text{uncac}_t + \sum_{i=1}^{4} \pi_{UNR}\, \text{rg}_{it} * \text{uncac}_t + \varepsilon_{jt}$$

(11) $$\text{cpin}_{jt}^{*} = \omega_0 + \omega_F \text{freedom}_{jt}^{*} + \omega_{DC}\text{dcp}_{jt}^{*} + \omega_{DF}\text{fdi}_{jt}^{*} + \omega_{EX}\text{ex}_{jt}^{*} + \omega_{imp}\text{imp}_{jt}^{*} + \omega_U \text{unempl}_{jt}^{*} + \omega_{UNCAC}\text{uncac}_t + \sum_{i=1}^{4} \omega_{UNR}\, \text{rg}_{it} * \text{uncac}_t + \varepsilon'_{Jt}$$

The computed values of the coefficients (π and ω) on the variables of the reduced-form equations (10) and (11) are determined as follow:

a) Coefficients πs in the reduced forms equation (10):

$$\pi_0 = \frac{\alpha_0 + \alpha_C\beta_0}{1 - \alpha_C\beta_G}; \qquad \pi_F = \frac{\alpha_F}{1 - \alpha_C\beta_G}; \qquad \pi_{DC} = \frac{\alpha_{DC}}{1 - \alpha_C\beta_G};$$

$$\pi_{DF} = \frac{\alpha_{FDI}}{1 - \alpha_C\beta_G}; \qquad \pi_{EX} = \frac{\alpha_{EX}}{1 - \alpha_C\beta_G}; \qquad \pi_{IMP} = \frac{\alpha_{IM}}{1 - \alpha_C\beta_G};$$

$$\pi_{UNCAC} = \frac{\alpha_C\beta_{UNCAC}}{1 - \alpha_C\beta_G}; \quad \pi_U = \frac{\alpha_C\beta_U}{1 - \alpha_C\beta_G}; \qquad \sum_{i=1}^{4} \pi_{UNR} = \sum_{i=1}^{4} \frac{\alpha_C\beta_{UNREG}}{1 - \alpha_C\beta_G}$$

b) Coefficients ωs in the reduced forms equation (11):

$$\omega_0 = \frac{\beta_0 + \alpha_0\beta_G}{1 - \alpha_C\beta_G}; \qquad \omega_F = \frac{\alpha_{F\beta_G}}{1 - \alpha_C\beta_G}; \qquad \omega_{DC} = \frac{\alpha_{DC\beta_G}}{1 - \alpha_C\beta_G};$$

$$\omega_{DF} = \frac{\alpha_{DF\beta_G}}{1 - \alpha_C\beta_G}; \qquad \omega_{EX} = \frac{\alpha_{EX\beta_G}}{1 - \alpha_C\beta_G}; \qquad \omega_{IMP} = \frac{\alpha_{IM}\beta_G}{1 - \alpha_C\beta_G};$$

$$\omega_{UNCAC} = \frac{\beta_{UNCAC}}{1 - \alpha_C\beta_G}; \qquad \omega_U = \frac{\beta_U}{1 - \alpha_C\beta_G}; \qquad \sum_{i=1}^{4} \omega_{UNR} = \sum_{i=1}^{4} \frac{\beta_G\beta_{UNREG}}{1 - \alpha_C\beta_G}$$

(a) and (b) indicate that the impact of each exogenous on the endogenous depend upon the product of the realization of the endogenous themselves (i.e. CPIN and GDPCP) obtained through the first stage of the estimation of the structural model.

Without taking into account the number of interaction between region and UNCAC, the model now has 16 estimable reduced-form coefficients and 8 structural coefficients. It is over-identified. Hence, reinforcing the identification suggested through the order and rank conditions. As Krishnakumar (1996) points out, a straightforward estimation of the coefficients for each structural equation of a SEM by ordinary (OLS) or generalized least squares (GLS) will lead to inconsistent estimates since the explanatory endogenous variables of the equation are correlated with both error terms.

(Gujarati 2004) suggests that estimating this model via the method of Indirect Least Squares is not appropriate and should be discarded in favor of other methods. One such method is the Two Stage Least Squares (2SLS) (Gujarati 2004).

Developed by Basmann (1957) and Theil (1958), 2SLS permits a computationally efficient estimation. Based on Sargan J-test which suggests that the over-identification restrictions are valid, the model equations were estimated using the 2SLS estimator for simultaneous equation with panel data in Statistical Analysis Software (SAS) software.

Like most popular statistical software packages, SAS does not automatically provide t-statistics for the estimated derived reduced coefficients. Consequently they are computed using a procedure suggested by Theil (1971 pp. 537-538)[1].

3.4 Data

Panel data used covers 20 countries in the SSA for the time period 1999-2013. Newly independent country such as South Sudan; or countries which are in perpetual war such as the Democratic Republic of Congo or Middle Africa Republic are dropped from the study.

These countries did not participate in the early corruption rankings. The list of countries which participate in the study is reported in table 3.5 (appendix 2). The dataset was accumulated from four main sources: Data on Per capita gross domestic product (GDP), domestic credit to private sector (DCP), direct foreign investment (FDI), unemployment rate (UNEMPL), Export (EX) and Import (IMP) are obtained from the World Bank. The corruption perception index (CPIN) is generated by Transparency International – the Global Anti-Corruption Coalition; while economic freedom index (FREEDOM) is obtained from the Heritage Foundation;

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[1]The derived reduced form can be stated as $Y=X\Pi$ where $\Pi = - B\Gamma$. The matrix B contains the coefficients estimates on exogenous variables of the system and the matrix Γ contains the coefficients on the endogenous variables of the system. The process for computing t-statistics for derived reduced form coefficients begins with augmenting the variance /covariance matrix from structural form estimation by adding rows and columns of zeros for the fixed coefficients (i.e., the endogenous and exogenous variables not appearing in each equation in the structural form). The final variance covariance matrix for the derived reduced form is calculated as $J\Delta J'$ where $J = - (\Gamma')^{-1} \otimes [\Pi| I]$. I is the identity matrix, Δ is the supplemented variance/covariance matrix described above. T-statistics are computed by dividing the roots of the elements of the diagonal of the $J\Delta J'$ into the derived reduced form coefficients (Π).

and the geographical location (RG) is based on the United Nations Statistics Division Scheme of geographic regions.

Per capita GDP, initially estimated at its current value, is adjusted for inflation to reflect its real U.S. Dollars value. Domestic credit to private sector (DCP) refers to financial resources provided to private sector by financial corporations, such as loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment (World Bank). It is measured as a percentage of GDP; the foreign direct investment (FDI) represents the direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital (World Bank). Like GDP, it is adjusted for inflation; UNEMPL is the rate of unemployment and it refers to the share of the labor force that is without work but available for and seeking employment. It is measured in percentage; the overall economic freedom index (FREEDOM) is based on ten quantitative and qualitative factors, grouped into four broad categories (rule of law, limited government, regulatory efficiency and open markets) of economic freedom. Each of the ten economic freedoms within these categories is graded on a scale of 0 (no freedom) to 100 (free country). A country overall score is derived by averaging these economic freedoms, with equal weight being given to each; the corruption perception index (CPIN) scores varies from 0 for highly corrupt to 10 for very clean countries; while the United Nations anti-corruption law (UNCAC) is created following the United Nations date of creation and implementation of the law. The background of the United Nations against Corruption and the goal of UNCAC are detailed in appendix 2. We also follow the United Nations composition of macro geographical (continental) regions to create the dummy variable RG. Table 3.1 and displays the summary statistics for variables used in the model and Table 3.2 shows the mean of the variables before and after implementation of UNCAC.

3.5 Estimation Results

As a preliminary step in the estimation process, we tested the validity of the over-identification restrictions, and checked for the exogeneity of the regressors used in the model. The results of the tests displayed in Table 3.3 show a J-statistics value of about 3.23 associated with a p-value equal 0.218, which based on Sargan test, suggests that the over-identification restrictions are valid. Furthermore, the results of the Wu-Hausman test shows a chi-square (χ^2) value of 2.85 with a p-value equal to 0.184; indicating the exogenous variable of the model are indeed valid.

The results of the structural and reduced form estimation are shown in Table 3.3, panels A and B. The structural form results will only be discussed briefly. Discussion of the results will focus on the more accurate reduced form coefficients, and how the significance and the sign of some coefficients changed between the structural and the reduced forms models.

3.5.1 *Structural form results*

Results of the structural estimation are reasonable in the sense that the models show good explanatory power and most of the coefficients are significant and have the signs which are consistent with economic theories. The adjusted R^2s for the model equations range from 0.79 and 0.83 for GDPCP and CPIN model respectively.

Table 3.3 Panel A displays the results of the structural estimation. The results indicate that higher foreign direct investment (FDI) as well as increase in domestic credit to private sector (DCP), and export of goods and services (EX) is associated with increase in per capita GDP, and are consistent with expectations. Per capita GDP grows by 1.15 percent, 0.19 percent and 10.19 percent given a 10 percent increase in FDI, DCP and EX respectively. The results also show that

economic freedom (FREEDOM) has a positive impact on per capita GDP. However, this impact is not significant. On the opposite side, increase in the volume of imported goods and services (IMP) contribute to significantly deteriorate the growth in per capita GDP in SSA. An increase in import volume by 10 percent leads to a decrease in per capita GDP by about 4.63 percent.

Our results also indicate dual causality between per capita GDP and the corruption perception index. We find that the coefficient on CPIN is significantly positive in the GDPCP equation, and the coefficient on GDPCP is positive and significant in the CPIN equation. This suggests that less corrupt countries perform economically better and countries with better economic growth experience less corruption. These results support the findings by Nageri et al. (2013) which indicate that increase in corruption has a negative on per capita GDP or the findings by Saha and Gounder (2013) which show that developed countries experience less corruption.

Table 3.3 shows that the sign on the coefficient of the variable anti-corruption policy (UNCAC) in the CPIN equation is negative and insignificant, indicating that the implementation of UNCAC does not have a dampening effect on the level of corruption in SSA. In fact, F-statistic equal 5.39 suggests H5 is rejected at $p < 0.05$. Hence, UNCAC effects appear to differ across the geographical locations of SSA. Only RG1 produce a positive and significant impact on CPIN at $p < 0.05$ while RG3 is significant only at $p < 0.6$. CPIN increases by about 0.52 percent after the implementation of UNCAC in Middle Africa region (RG1) while the increase is 0.18 percent in Southern Africa (RG3). In East Africa (RG2) as well as in West Africa (RG4), this impact is positive but statistically insignificant.

The results also display an interesting nexus between UNEMPL and CPIN. Increase in unemployment significantly increases corruption perception (or unemployment decreases the level of corruption).

3.5.2 *Reduced form results*

The reduced form coefficients for GDPCP and CPIN equations are substantially different from the structural form coefficients. When all the exogenous variables of the model are allowed to filter in the whole system, the sign on the intercept in the GDPCP equation as well as the magnitude and significance of the impacts of some exogenous variables changed. In fact, reduced form model results reveal a fundamental link between GDPCP and CPIN. Table 3.3 Panel B displays the reduced form model results.

In GDPCP equation, the sign and significance of the variable FDI on GDPCP are similar to those observed under the structural form equation. However, the magnitude of the impact increases. The results indicate that as Foreign Direct Investment increases by 10 percent, per capita GDP grows by about 1.44 percent. Foreign Direct Investment is a dominant tool of economic development and is of particular importance for less developed countries such as countries in SSA. It allows capital-poor SSA countries to enhance physical capital, generate employment opportunities and improve economic conditions of the region. Like FDI, DCP appears to be a relatively important factor in explaining increase in per capita GDP. Per capita GDP increases by 7.8 percent as domestic credit to private sector increases by 10 percent. Without changing their sign from the structural form equation, the coefficients on EX, FREEDOM and that of IMP also increase in magnitude. The results indicate that the coefficient on EX on GDPCP is the largest. Per capita GDP grows by 12.8 percent when the volume of exported goods and services increases by 10 percent, suggesting that SSA's per capita GDP trend

is intimately associated with its export volumes. The structural results indicated that the impact of FREEDOM was not significant whereas the reduced form coefficient on FREEDOM is positive and significant, suggesting that improving economic freedom is fundamental for SSA economic growth. Specifically, when SSA economic freedom increases by 10 percent; per capita GDP grows by about 8.76 percent. This result is interesting in part as it illustrates the importance of the reduced form estimation while also supporting the finding by Cebula amd Mixon (2013) or Doucouliagos and Ulubasoglu (2003) which find an overall positive direct association between economic freedom and economic growth. On the opposite side, per capita (GDP) decreases significantly with increase in import volumes. When import increases by 10 percent, per capita GDP declines by almost 6 percent. This negative nexus between per capita GDP and import of goods and services could be explained by the fact that SSA has been a food-trade deficit since the mid-1970s (Rakotoarisoa et al. 2012). Consequently, significant monetary value spent on imports leaves the region, and thus decreases the SSA's GDP.

The structural form estimation has shown that UNEMPL has a positive and significant impact on CPIN. Similar result is observed in the reduced form equation of CPIN where an increase by 10 percent in the rate of unemployment is followed by an increase in corruption perception index by 1.86 percent. In turn, CPIN feeds this positive impact to GDPCP. However, the results indicate that unemployment produces a positive but significant effect on per capita GDP. These results display a fascinating relationship between unemployment and corruption perception index, and an argument can be made with respect to this relationship. In fact, corruption perception index measures how corrupt a public sector in a country is seen to be. However, in SSA, less and less people find employment in the public sector (or even in the private sector). Consequently, the amount of individuals who could potentially participate in the

corruption scheme also decreases. Hence, justifying this observed scanty nexus. This result supports the findings by N'Zue and N'guessan (2006) which indicates that poverty decreases corruption. Indeed, the lack of strong safety net in SSA move unemployed individual quickly in the group of poor individuals. As such, increase in unemployment is followed by an increase in the rate poverty. Consequently, one should expect unemployment and poverty to produce similar impacts on corruption.

The results of the reduced form equation CPIN show that UNCAC has a negative and insignificant impact on corruption perception index. Similar result is observed in the reduced form equation for GDPCP, suggesting that the UN anti-corruption policy has failed in its fundamental goal of eradicating corruption and improving economic growth in SSA. However, the results of the reduced form equation show that the coefficient on RG1 produces a positive and statistically significant impact on CPIN, which in turn filters this impact at the GDPCP. Hence, per capita GDP in Middle Africa grows better after the implementation of the policy.

Table 3.3 panel B also shows that all of the variables which produce a significant impact on the reduced form equation GDPCP also produce significant impacts on corruption perception index. The coefficients on FDI, DCP, EX all have a positive and significant effect on CPIN while the coefficient on IMP in CPIN equation is negative and statistically significant. These results suggest that Corruption decreases by 0.3 percent, 1.54 percent and 2.54 percent given a 10 percent increase in foreign direct investment, domestic credit to private sector and export respectively. On the opposite site, the level of corruption increases by 1.16 percent when import increases by 10 percent.

The results of the model indicate that most coefficients on the variables of the model (FDI, DCP, EX, IMP, FREEDOM and UNEMPL) are fundamental in determining corruption

and economic growth. To provide a further evidence of their importance, following Kinnucan et al. (2012) and Diffy (1989), we multiply these elasticity coefficients by the percentage change in the respective variables between pre-and post-UNCAC. Table 3.4 displays the magnitude of the change in these values.

3.6 Concluding comments

The tandem "corruption-economic growth" has been received significant amount of attention during the last decades, at least in SSA, making the identification of factors that propel their very existence crucial for economic development and social welfare. Study results based on simultaneous equation model with panel data suggest SSA economic growth and corruption are intimately linked.

The study clearly shows a significant dual relationship between corruption and economic growth: decrease in corruption in SSA leads to increase in its per capita GDP. In return, increase in GDP per capita is followed by a decrease in the general level of corruption in the region. In fact, economic factors such economic freedom, export of goods and services, foreign direct investment and domestic credit to private sector all have a positive nexus with economic growth; while the nexus between import of goods and services and economic growth is statistically negative. The relationships between these economic factors and per capita GDP quickly filter in the corruption mechanism, giving factors such as economic factors such economic freedom, export of goods and services, foreign direct investment as well as domestic credit to private sector a dampening effect on corruption, while on the opposite side, increase import volumes provide an uplifting impact. As for UNCAC of 2003, model results suggest the implementation of anti-corruption policy had a negative impact on corruption while increasing GDP per capita in Middle Africa. Corruption decreases by 0.65 percent while GDPCP increases by 0.67 percent

after implementation of the policy. However, the measured impacts on corruption and economic growth in East Africa, Southern Africa and West Africa were mostly nil. This indicates the adoption and implementation of UNCAC in SSA countries has failed in its very fundamental ambition which is to eradicate corruption while improving economic growth and economic development throughout the continent. In fact, these results solve our contention with Nageri et al. (2013) which advocate for a strict implementation of UNCAC without testing its effects neither on the level of corruption nor on GDP per capita.

Our results also indicate that increase in unemployment leads to decrease in corruption. Nevertheless, this does not suggest that unemployment should be considered a panacea in alleviating corruption. What it does display however, is the magnification of the culture of corruption in work places. As such, when less people are employed, less participate in the corruption scheme, and the intensification of corruption decreases.

The empirical results provide two key findings: a) factors that decreases/increases corruption, increase/decreases economic growth and b) factors that increases/decreases economic growth, decreases/increase corruption.

Table 3.1: Summary statistics for variables used in the model.

Variable	Definition	Mean	SD	Min	Max
GDPCP	per capita GDP, US Dollars	1907.96	2192.29	149.37	9476.84
CPIN	Corruption perception index,	33.33	12.56	1.50	65.00
FREEDOM	Economic freedom	59.23	5.63	48.40	77.00
DCP	Domestic credit to private sector, percent	30.20	34.68	4.09	160.13
FDI	foreign direct investment, millions of US Dollars	0.00	0.00	0.00	0.00
EX	Export of goods and services, percent	32.41	12.91	10.17	68.46
IMP	Import of goods and services, percent	38.85	13.50	12.94	77.82
UNEMPL	Unemployment rate, percent	10.28	6.91	2.00	37.60
	Dummy Variables				
UNCAC	United Nations Anti-corruption policy	0.604	0.490	0	1
RG1	Middle Africa	0.041	0.198	0	1
RG2	Souther Africa	0.279	0.450	0	1
RG3	East Africa	0.122	0.328	0	1
RG4	West Africa	0.162	0.369	0	1

Table 3.2: Mean of variable before and after UNCAC

Variable	Means Before UNCAC (1999-2005)	Means After UNCAC implementation (2006-2013)	Percentage change
GDPCP	1225.96	2355.84	92
CPIN	32.0625	34.156	6.5
FREEDOM	59.076	59.327	0.43
DCP	25.850	33.0562	27.88
FDI	406.208	1,525.028	275.43
EX	32.1345143	32.5881159	1.41
IMP	36.571	40.353	10.34
UNEMPL	10.764	9.969	-7.39

Table 3.3: 2SLS estimated the impacts of UNCAC and others variables on corruption and per capita GDP, 1999-2013

	Panel A: Structural results Adjusted R^2=0.75		*Panel B: Structural results Adjusted R^2=0.88*	
	GDPCP	CPIN	GDPCP	CPIN
Cons	0.00	-0.037	-0.047	-0.046
	(0.040)	(0.039)	(0.046)	(0.042)
FDI	0.115***		0.144*	0.029*
	(0.034)		(0.037)	(0.012)
DCP	0.019**		0.778**	0.154*
	(0.061)		(0.053)	(0.032)
FREEDOM	0.697		0.876*	0.174*
	(1.288)		(0.440)	(0.08)
EX	1.019***		1.280**	0.254*
	(0.126)		(0.135)	(0.092)
IMP	-0.463*		-0.582*	-0.116*
	(0.197)		(0.201)	(0.061)
UNEMPL		0.148**	0.191	0.186*
		(0.049)	(0.153)	(0.091)
GDPCP		0.199***		
		(0.033)		
CPIN	1.026*			
	(0.423)			
UNCAC		-0.062	-0.080	-0.078
		(0.073)	(0.060)	(0.071)
RG1		0.520**	0.671*	0.654*
		(0.134)	(0.151)	(0.176)
RG2		0.111	0.143	0.139
		(0.076)	(0.091)	(0.102)
RG3		0.181*	0.234	0.228
		(0.095)	(0.157)	(0.162)

Sargan J-statistic:: (χ^2 = 3.23; p = 0.218) ***Wu- Hausman***: (χ^2 = 2.85; p = 0.184)

Note: 1: *** Significance at 1%; ** Significance at 5%; and * Significance at 10%

2. Standard errors are shown in parentheses.

Table 3.4: Estimated effects of changes in model variables

Variable	Reduced form coefficient		Level of variable		percentage change	Predicted Change in coefficient (Percent)	
	GDPCP	CPIN	1999 - 2005	2006-2913		GDPCP	CPIN
FREEDOM	0.876	0.174	59.076	59.327	0.4	0.350	0.0696
DCP	0.778	0.154	25.85	33.0562	27.9	21.71	4.2966
FDI	0.144	0.029	406.208	1,525.03	275.43	39.662	7.98747
EX	1.28	0.254	32.1345	32.5881	1.41	1.804	0.35814
IMP	-0.582	-0.116	36.571	40.353	10.3	-5.995	-1.1948
UNEMPL	0.191	0.186	10.764	9.969	-7.4	-1.413	-1.3764

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Appendix 1

Figure 2.1: evolution of test scores and school enrollment in Alabama city school systems

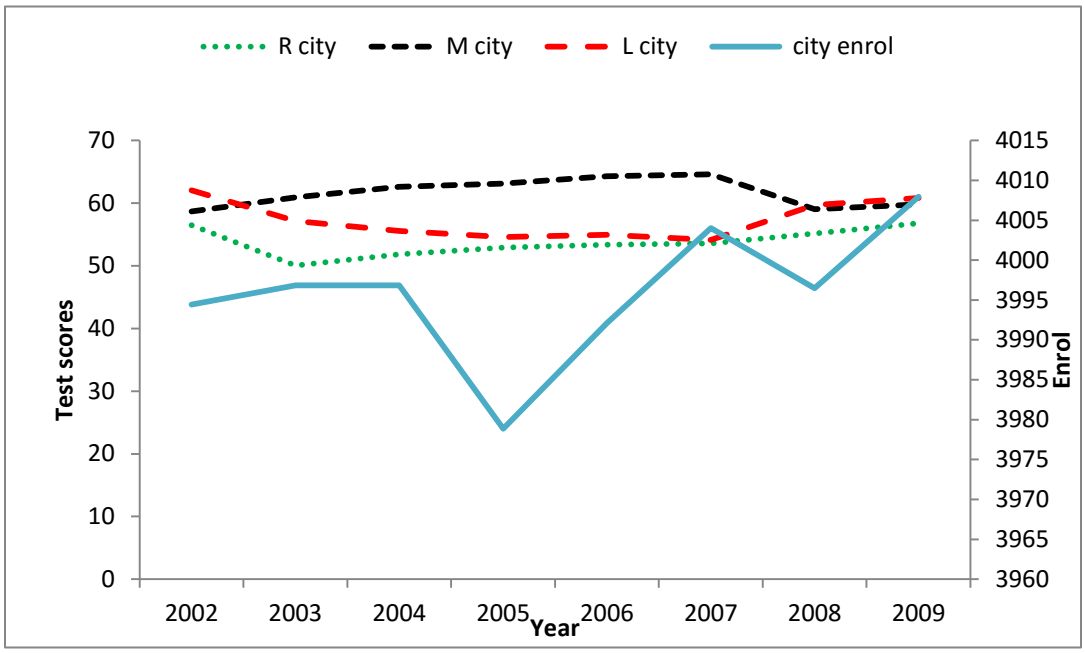
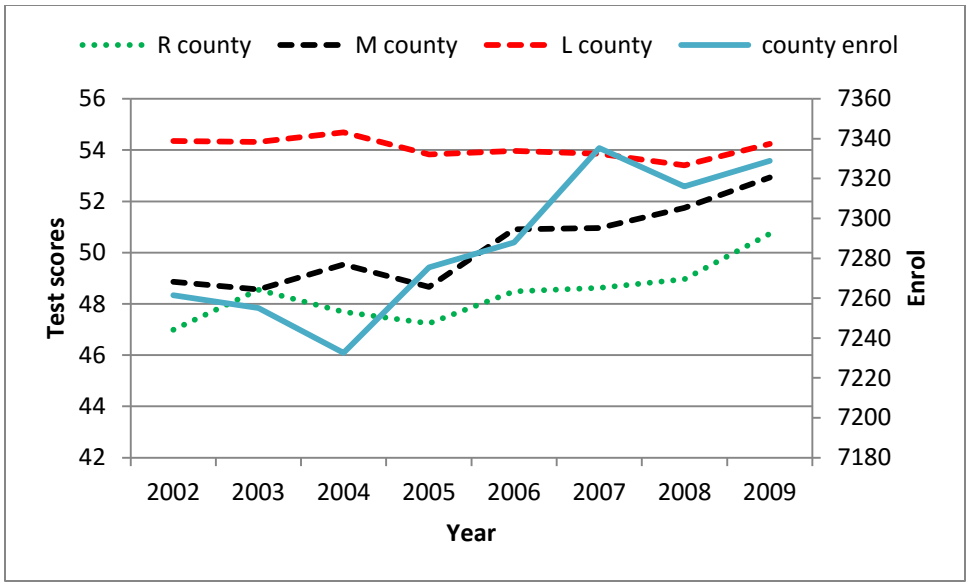


Figure 2.2: evolution of test scores and school enrollment in Alabama county school systems



Appendix 2

Background of the United Nations against Corruption

In its resolution 55/61 of 4 December 2000, the General Assembly recognized that an effective international legal instrument against corruption, independent of the United Nations Convention against Transnational Organized Crime (resolution 55/25, annex I) was desirable and decided to establish an ad hoc committee for the negotiation of such an instrument in Vienna at the headquarters of the United Nations Office on Drugs and Crime. The text of the United Nations Convention against Corruption was negotiated during seven sessions of the Ad Hoc Committee for the Negotiation of the Convention against Corruption, held between 21 January 2002 and 1 October 2003.

The Convention approved by the Ad Hoc Committee was adopted by the General Assembly by resolution 58/4 of 31 October 2003. The General Assembly, in its resolution 57/169 of 18 December 2002, accepted the offer of the Government of Mexico to host a high-level political signing conference in Merida for the purpose of signing the United Nations Convention against Corruption. In accordance with article 68 (1) of resolution 58/4, the United Nations Convention against Corruption entered into force on 14 December 2005. A Conference of the States Parties is established to review implementation and facilitate activities required by the Convention.

Prevention

Corruption can be prosecuted after the fact, but first and foremost, it requires prevention. An entire chapter of the Convention is dedicated to prevention, with measures directed at both the public and private sectors. These include model preventive policies, such as the establishment of anticorruption bodies and enhanced transparency in the financing of election campaigns and political parties. States must endeavor to ensure that their public services are subject to safeguards that promote efficiency, transparency and recruitment based on merit. Once recruited, public servants should be subject to codes of conduct, requirements for financial and other disclosures, and appropriate disciplinary measures. Transparency and accountability in matters of public finance must also be promoted, and specific requirements are established for the prevention of corruption, in the particularly critical areas of the public sector, such as the judiciary and public procurement. Those who use public services must expect a high standard of conduct from their public servants. Preventing public corruption also requires an effort from all members of society at large. For these reasons, the Convention calls on countries to promote actively the involvement of non-governmental and community-based organizations, as well as other elements of civil society, and to raise public awareness of corruption and what can be done about it. Article 5 of the Convention enjoins each State Party to establish and promote effective practices aimed at the prevention of corruption.

Criminalization

The Convention requires countries to establish criminal and other offences to cover a wide range of acts of corruption, if these are not already crimes under domestic law. In some cases, States are legally obliged to establish offences; in other cases, in order to take into account differences in domestic law, they are required to consider doing so. The Convention goes beyond

previous instruments of this kind, criminalizing not only basic forms of corruption such as bribery and the embezzlement of public funds, but also trading in influence and the concealment and laundering of the proceeds of corruption. Offences committed in support of corruption, including money-laundering and obstructing justice, are also dealt with. Convention offences also deal with the problematic areas of private-sector corruption.

International cooperation

Countries agreed to cooperate with one another in every aspect of the fight against corruption, including prevention, investigation, and the prosecution of offenders. Countries are bound by the Convention to render specific forms of mutual legal assistance in gathering and transferring evidence for use in court, to extradite offenders. Countries are also required to undertake measures which will support the tracing, freezing, seizure and confiscation of the proceeds of corruption.

Asset recovery

In a major breakthrough, countries agreed on asset-recovery, which is stated explicitly as a fundamental principle of the Convention. This is a particularly important issue for many developing countries where high-level corruption has plundered the national wealth, and where resources are badly needed for reconstruction and the rehabilitation of societies under new governments. Reaching agreement on this chapter has involved intensive negotiations, as the needs of countries seeking the illicit assets had to be reconciled with the legal and procedural safeguards of the countries whose assistance is sought. Several provisions specify how cooperation and assistance will be rendered. In particular, in the case of embezzlement of public funds, the confiscated property would be returned to the state requesting it; in the case of

proceeds of any other offence covered by the Convention, the property would be returned providing the proof of ownership or recognition of the damage caused to a requesting state; in all other cases, priority consideration would be given to the return of confiscated property to the requesting state, to the return of such property to the prior legitimate owners or to compensation of the victims. Effective asset-recovery provisions will support the efforts of countries to redress the worst effects of corruption while sending at the same time, a message to corrupt officials that there will be no place to hide their illicit assets. Accordingly, article 51 provides for the return of assets to countries of origin as a fundamental principle of this Convention. Article 43 obliges state parties to extend the widest possible cooperation to each other in the investigation and prosecution of offences defined in the Convention. With regard to asset recovery in particular, the article provides inter alia that "In matters of international cooperation, whenever dual criminality is considered a requirement, it shall be deemed fulfilled irrespective of whether the laws of the requested State Party place the offence within the same category of offence or denominate the offence by the same terminology as the requesting State Party, if the conduct underlying the offence for which assistance is sought is a criminal offence under the laws of both States Parties".

Table 3.5 List of African countries participating in the study

Country	Location			
	Middle Africa	East Africa	Southern Africa	West Africa
Angola	+			
Cameroon	+			
Chad	+			
Ghana				+
Ivory Coast				+
Nigeria				+
Botswana			+	
Namibia			+	
South Africa			+	
Zambia		+		
Kenya		+		
Malawi		+		
Mauritius			+	
Mozambique			+	
Tanzania		+		
Uganda		+		
Gabon	+			
Senegal				+
Burkina				+
Equatorial Guinea	+			