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# Elements deciding meat exchange to the Asian and African business sectors: Its suggestion to the Namibian meat industry

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Abstract

**The primary objective of this study is to identify alternative export markets for Namibian meat and meat products. This study applied the Extended Gravity Model to a cross-sectional dataset of global trade for fresh beef and frozen beef, as well as sheep and goat meat, based on 2009 trade data to identify key determinants of the above-mentioned products trade flows in a regional perspective. The variables used in this study include the impact of income, per capita income, distance, and exchange rates, as well as dummy variables, for regional blocs' supply to the specific region or country partners. The results of this study have two significant policy implications for Namibia. Firstly, trade agreements – whether implemented unilaterally or bilaterally – will enhance potential trade flows between Namibia and other countries or regions. Equally, it is also important to protect and advocate productivity growth within the context of these trade arrangements. Secondly, GDP per capita was found to be positively related and significant in Southern and West Africa for fresh beef. Fresh beef was found significant in all cases, while goat and sheep meat was only significant in East Africa. The study revealed that a higher income per capita is a major indicator of potential export opportunity. Denser populated nations may have higher demand for protein commodities such as meat, but a higher population either increase or decrease trade, depending on GDP per capita. In Asian markets, per capita income was found to be significant at 1 % and highly elastic, making these markets attractive export destinations. As far as Namibia's ability to compete with Oceania and North America is concerned, Namibia has a good opportunity to acquire a share of the Asian market.**

**Keywords:** Meat industry, extended gravity model, export destination.

## INTRODUCTION

Although agriculture contributes only about 6% to the Gross Domestic Product (GDP), it is regarded as an important part of the Namibian economy due to the facts that: Firstly, it is considered as one of the means of a poverty alleviation strategy; secondly, it employs 37% of the work force, and lastly, it sustains 70% of the Namibian population (Mushendami et al., 2008).

Beef industry in Namibia is the main agricultural production sector in the country, with the value of production estimated at an annual $90 million, of which approximately $45 million is contributed by cattle weaner exports. The average number of cattle was estimated at around 2.3 million in 2006 (Meat Board of Namibia, 2007). The sector's contribution to the economy is

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estimated at about 75% to the total agricultural economy, 69% of which is estimated to be from commercial livestock production (Emongor, 2007). Beef production is the most important part of the sector, followed by small stock (sheep and goat) production.

The sector can be categorised into commercial and communal sectors. The commercial farming sector constitutes approximately 4,200 farmers and occupies 44% of the arable land, whereas communal farmers account for 41% of the agricultural land and are estimated to make up 67% of the total population, 90 % of who are dependent on subsistence agriculture for their livelihood (Emongor, 2007).

Cattle numbers in Namibia and exports in beef and veal have showed an increasing trend since 1996, while live export has declined as a result of government policy on the value addition concept (Kruger et al., 2008).

Namibia enjoys a beef export quota of 13,000 tons to the European Union under the EU/ACP trade agreement. The EU market accounts for 40% of Namibia's beef product exports (Emongor, 2007).

Therefore, within the above context, this research provides insight into the major central attractions for global meat exporters when it comes to exporting to specific regions or countries. This will help to identify key determinants/attributes that can contribute to increased trade volumes to different countries or regions, using the Extended Gravity Model (EGM) supported by the Weighted Least Square (WLS) econometrical model, applied to the 2009 United Nations

Conference on Trade and Development (UNCTAD) cross-sectional dataset on fresh or chilled beef (HS0201). This section provides possible export promotion efforts to the Namibian meat industry, considering important variables that can ensure successful world exports.

**Problem statement and motivation of the study**

Namibia is, and will remain, a net exporter of livestock and red meat products over the long term, but the current situation where Namibian exports are limited to only a few countries, including South Africa (SA; 46%), the EU (29%) and Norway (2%), is raising concerns due to the recent proposed termination of the provisional preferences in the Interim Partnership Agreement with the European Union by 2014. This forces Namibia to explore possible new export opportunities to diversify its export markets. Therefore, the primary objective of this study is to identify and analyse alternative export markets for the Namibian red meat industry besides the EU, SA and Norway (OECD/FAO, 2011).

With the expiry of the waiver notified to the World Trade Organization (WTO) by the European Union (EU) as part of the Cotonou Agreement at the end of 2007, preferential market access for Namibia into the EU theoretically came to an end. The succeeding Interim Economic Partnership Agreement (IEPA)[1] negotiated between certain Southern Africa Development Community (SADC) countries and the EU earmarked a WTO-compatible Free Trade Agreement which had to be initialled before the end of 2007 to maintain preferential market access for Namibian products to the EU markets. While negotiating an Economic Partnership Agreement (EPA), the EU offered Namibia, as well as Botswana and Swaziland, duty-free quota-free access for their beef products to the EU. A recent proposal by the European Commission envisages terminating the interim EPA by 2014.

To address the possible loss of preferential access to the EU market, the meat industry was informed by the Ministry of Trade and Industry (MTI) of a Cabinet decision that future reliance on one export destination is not in the interests of Namibia and that no single export destination should be responsible for more than 50% of all exports of a specific commodity. Consequently, the Ministry requested the meat industry to come up with a proposal for the diversification of the current markets for Namibian meat and meat products (Namibia Meat Board, 2012).

Diversifying meat exports by exporting to the existing markets, and exporting new products to new markets, will stimulate economic development and lower the sector's vulnerability to economic instability in export markets. Export development by means of market diversification could create trade by unlocking additional supply potential. However, if additional supply is not sufficient for the new export opportunities, trade diversion may occur. Hence, new export opportunities should be capitalised in conjunction with a sound supply strategy for the Namibian meat sector.

Food and Livestock Planning Inc. (2010), cited in Meat Board of Namibia (2012), conducted a study specifically looking at the export opportunities for Namibia in the US market. They found that there were opportunities for grass-fed Namibian beef, which were underpinned by potential customers, although these were limited by international competition, regulatory issues, and financial viability. Based on import-growth performance, the study also looked at the Central East, Ghana, Russia, China and the expansion of existing markets, without going into much detail (Namibia Meat Board, 2012).

In brief, some of the suggested international trade and meat industry policies, as cited in Meat Board of Namibia (2011) and the Namibia Agriculture Marketing and Trade Policy and Strategy (2nd draft 19 July-11), are for Namibia meat industry to:

1. Utilize its policy space to preserve breeding material and discourage uncontrolled/unrestricted exports of livestock;
2. Promote value addition to diversify the product range;

[1] SADC EPA Configuration of Southern African countries that negotiate together on trade in goods with the EC: Angola, Mozambique (SADC member states); Botswana, Lesotho Namibia, Swaziland and South Africa (SACU member states)

3. Promote the optimal utilization of the domestic market for Namibian products;
4. Develop, promote, maintain and where appropriate improve sanitary requirements, and ensure compliance with standards and quality of livestock and livestock products exported from Namibia;
5. Support and ensure that Namibian products meet local standards;
6. Devise, maintain and improve where appropriate an efficient and effective marketing system for livestock and livestock products in order to stimulate production;
7. Develop domestic livestock and livestock products markets through, amongst others, promotion of local consumption of locally originating meat and meat products;
8. Promote integration of the informal market into mainstream economy;
9. Promote the development of a competitive agro-industry; and
10. Ensure equitable/equal/fair distribution of benefits across the value chain.

**DATA USED AND METHODOLOGY**

The gravity model of trade has been used widely as a baseline model for estimating the impact of a variety of policy issues, including regional trading groups, currency unions, political blocs, patent rights, and various trade distortions. Typically, these events and policies are modelled as deviations from the volume of trade predicted by the baseline gravity model and, in the case of regional integration, are captured by dummy variables. The fixed effects gravity equation, one of the popular methodologies used, allows for unobserved or miss-specified factors that simultaneously explain trade volume between two countries and, for example, the probability that the countries will be in the same regional integration regime (Cheng and Wall, 2005). Gravity models with fixed effects have also been used by Glick and Rose (2001) and Pakko and Wall (2001) to estimate the trade effects of currency unions, and by Millimet and Osang (2004) to estimate the effects of borders on trade.

These models are restricted versions of a general gravity model, which has a log-linear specification but places no restrictions on the parameters. In the general model, the volume of trade between countries *I* and *j* in year *t* can be characterized by:

$$\ln X_{ijt} = a0 + a_t + a_{ij} + b\text{¢}ijt + Zijt + e_{ijt},\ t = 1,\ldots,T. \quad (1)$$

Where ijt is exports from country *i* to country *j* in year *t* and Z¢ijt = [*zit*, *zjt* …] is the 1 × *k* vector of gravity variables (gross domestic product [GDP], population, and distance). The intercept has three parts: One common to all years and country pairs, a0; one specific to year *t* and common to all pairs, a*t*; and one specific to the country pairs and common to all years, a*ij*. The disturbance term, e*ijt*, is assumed to be normally distributed with zero mean and constant variance for all observations. It is also assumed that the disturbances are pair-wise uncorrelated. Obviously, one observation, it is not useful for estimation unless restrictions are imposed on the parameters. The standard single-year cross-section model (CS) imposes the restrictions that the slopes and intercepts are the same across country pairs, that is, a*ij* = 0 and bijt=bt,

$$(CS)\ \ln X_{ijt} = \alpha_0 + \alpha_t + \beta'_t Z_{ijt} + \varepsilon_{ijt},\ t = 1,\ldots,T \quad (2)$$

where a0 and a*t* cannot be separated. Assuming that all the classical disturbance-term assumptions hold, the CS model is estimated by ordinary least squares (OLS) for each year. The other standard estimation method is a pooled-cross-section model (PCS), which imposes the further restriction on the general model that the parameter vector is the same for all *t*, b1 = b2 = bT = b, although it normally allows the intercepts to differ over time:

$$(PCS)\ \ln X_{ijt} = a0 + a_t + b\text{¢}\ Zijt + e_{ijt},\ t = 1,\ldots,T \quad (3)$$

This is estimated by OLS using data for all available years. Nearly all estimates of the gravity model of trade use either the CS or the PCS model, which, as we show below, both provide biased estimates.

To address bias in the equation, it can equate to maintain the restriction that the slope coefficients are constant across country pairs and over time. Specifically, we estimate the fixed effects (FE) model of Cheng and Wall (2005):

$$(FE)\ \ln X_{ijt} = a0 + a_t + a_{ij} + b\text{¢}\ Zijt + e_{ijt},\ t = 1,\ldots,T \quad (4)$$

Note that the country-pair effects are allowed to differ according to the direction of trade (that is, a*ij* # a*ji*). The FE model is a two-way fixed-effects model in which the independent variables are assumed to be correlated with a*ij* and is a classical regression model that can be estimated using LSDV (least squares with a dummy variable for each of the country pairs).

As mentioned previously, others have proposed alternative fixed-effects models to handle country pair heterogeneity, each of which can be modelled as a restricted version of the FE model above. The Symmetric Fixed-Effects (SFE) model of Glick and Rose (2001) differs from FE only in that it imposes the restriction that the country-pair effects are symmetric (that is, a*ij* = a*ji*).

In the Cheng and Wall (2005) model, call it DFE, the differences in the dependent and independent variables are used to eliminate the fixed variables, including the country-pair dummies and distance. As with the FE specification, this model allows for the most general fixed effects possible. But rather than estimating the fixed effects using LSDV, it eliminates by subtracting out. Specifically,

$$(DFE)\ D\ln X_{ijt} = g0 + g_t + b\text{¢}DZijt + \mu_{ijt},\ t = 1,\ldots,T \quad (5)$$

Where D is the difference operator and g0 + g*t* = a*t*– a*t* –1. In this model, the intercept has two parts: g0 is the change in the period-specific effect that is common across years and g*t* is the change that is specific to year *t*.

When there are no time dummies, such a differencing model yields results identical to a model with dummy variables to control for fixed effects. However, with time dummies it is necessary to impose restrictions on the time effects to avoid collinearity, which in turn makes the DFE estimation a restricted form of the FE estimation.

If the collinearity restriction is that the first time dummy in the DFE model is equal to zero, this is equivalent to restricting the common component of the change in the period-specific effects as equal to the difference in the first two period-specific effects (that is, g0 = a2 – a1). If, instead, the collinearity restriction is that the sum of the time dummies in the DFE model is zero, this is equivalent to restricting the common component as equal to the difference between the first and last time dummies (that is, g0 = a*T* – a1) (Mátyás, 1997).

According to Brülhart and Kelly (1999), typical gravity models include the following variables as determinants of trade:

1. Export supply, captured by economic factors (national output or output per capita) affecting trade flows in exporting countries;
2. Import demand, captured by economic factors (income or income

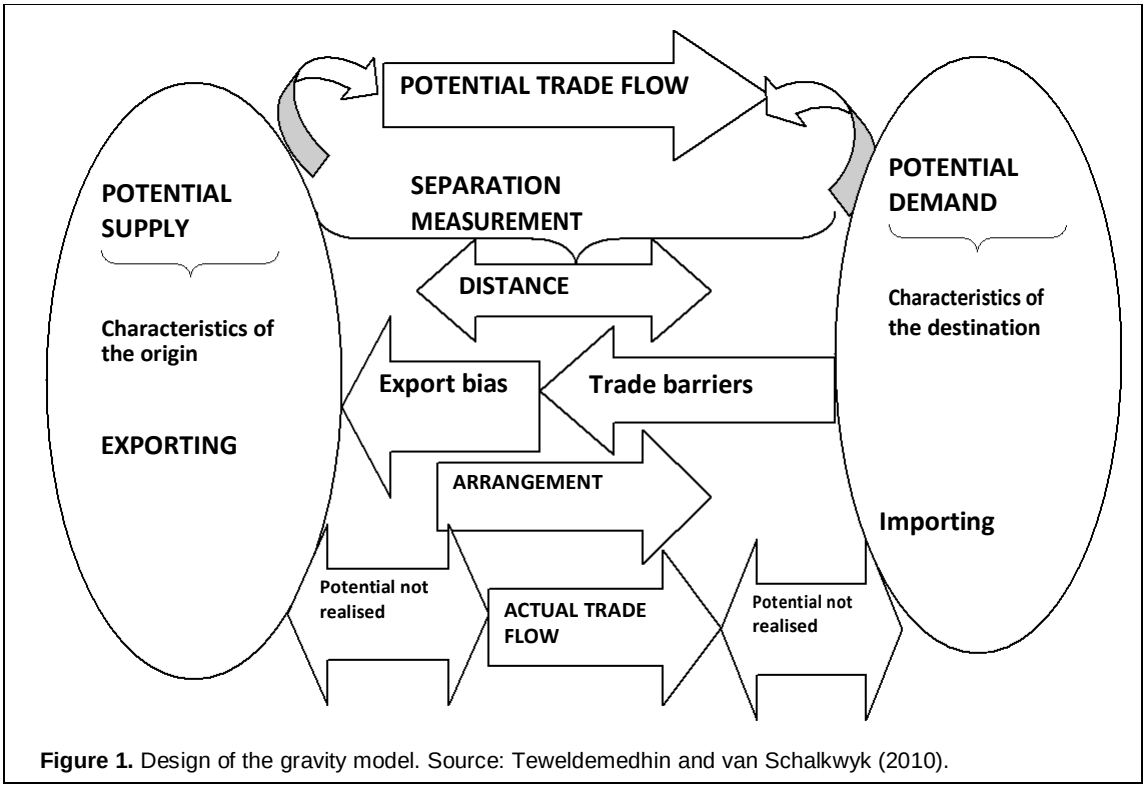


**Figure 1.** Design of the gravity model. Source: Teweldemedhin and van Schalkwyk (2010).

per capita) affecting trade flows in the importing countries; and
3. Transportation costs, captured by geographical distance and other variables representing policy and cultural barriers to trade.

An alternative explanation of the gravity model is presented in Figure 1, using a simple supply-and-demand framework. According to Teweldemedhin and van Schalkwyk (2010), exporting and importing countries are the main objects in a gravity model. In Figure 1, the gravity model is presented graphically to show the potential supply and demand, determined by the sizes of the economies, to predict the potential trade flow between the countries as trading partners. This flow is subject to certain trade resistance factors that are improved by trade arrangements.

Following the above theoretical background in this study as Bikker (2009) used Gravity Model (EGM) to examine bilateral trade flows considering four sets of variables, namely supply, demand, allocation and index system equations:

1. Supply side: Variables indicating the total potential supply of the exporting country i;
2. Demand side: Variables indicating the total potential demand of the importing country j;
3. Related to allocation index: Geographical distance between the countries' capitals (or economic centres); and
4. Variables aiding or hindering trade between the importing and exporting countries.

Therefore, for estimation purpose, Equation (3) above can be expressed in log linear form as follows:

$$\ln Exp = \ln GDPc + \ln POP + D1 + D2 + \ln DIS + \ln SUPP + \ln EX + \varepsilon ij \quad (6)$$

Where: Exp represents export supply of a specific exporting country to a specific region; GDPc is the GDP per capita of the importing countries; D1 is a dummy variable for influence of regional trade agreement; D2 is a dummy variable for export to the specific region/countries; SUPP indicates the total supply contribution of exporting countries to world; EX presents exchange rate of specific importing countries against the US dollar; DIS is the distance of export origin to destinations; $\varepsilon ij$ is a random error term, usually taken to be normally distributed.

To determine the contributors to trade to certain African regions or countries, an Ordinary Least Square (OLS) econometrical model was applied to 2009 cross-sectional data on fresh or chilled beef (HS0201), frozen beef (HS0202) and fresh, chilled or frozen mutton, lamb and goat meat fresh, chilled or frozen mutton, lamb and goat meat (HS0204). This tool is useful for measuring key economic drivers to export or trade patterns. Therefore, this study explores the key drivers of trade to specific African regions or countries and the level of specialisation and/or diversification of the global meat industry. Table 1 presents the variables influencing meat exports to different destinations as a dependent variable, with possible factors influencing the dependent variables, with the expected sign in the EGM.

Gravity has long been one of the most successful empirical models in economics. Incorporating deeper theoretical foundations of gravity into recent practice has led to a richer and more accurate estimation and interpretation of the spatial relations described by gravity. Wider acceptance has followed. However, it is important to point out the limitations and superiority of the model:

1. The major limitation of the gravity model is the narrow focus on trade volume and the inability to generate predictions in direction of trade or distributional impacts and the failure to account relative to Preferential Trade Agreements (PTAs) and their effect on changes in trade policy. In addition, explicit links between changing production/consumption patterns and trade structure only rely on setting to one or more PTA dummy variables. This approach is problematic as the dummy variables may or may not capture a range of other effects.
2. Another criticism of gravity studies is their inability to take into account the terms-of-trade adjustments accompanying preferential

**Table 1.** Expected sign and explanation of variables.

| Variable | Code | Sign | Explanation | Source of data |
|---|---|---|---|---|
| Importer GDP per capita | GDPc | + | Economically larger countries import more | World Bank (2009) |
| Population | POP | ± | A higher output per person indicates a higher import demand, but a larger population may both increase and decrease trade | World Bank (2009) |
| Distance | DIST | - | Appears to explain transportation costs. | UNCTAD (2009) |
| Dummy intra exports within the same region | D1 | ± | If present, trade agreements will enhance trade between those countries – otherwise the opposite | |
| Dummy EU countries' trading partners | EU | - | Trade agreements will enhance trade between these countries, but with EU farmers being subsidised will discourage export from the rest of the world | UNCTAD(2009) |
| Total supply of exporting countries to the world | SUPP | ± | Diversification in the export orientation will have a negative effect, leading to low supply and demand, while non-diversification will have a positive effect on the region. | UNCTAD (2009) |
| Real exchange rates | EXE | ± | Appreciation in the importing country's currency promotes exports from that country and hinders imports | IMF (2009) |
| Population | POP | ± | A higher output per person indicates a higher import demand, but a larger population may both increase and decrease trade | World Bank (2009) |
| Distance | DIST | - | Appeared to explain transportation costs. | UNCTAD (2009) |
| Dummy exports from Africa to Africa | AFRI | ± | If present, trade agreements will enhance trade between those countries – otherwise the opposite. | |
| Dummy EU countries' trading partners | EU | - | Trade agreements will enhance trade between these countries, with being EU farmers subsidised will discourage export from the rest of the world | |
| Total supply of exporting countries to the world | SUPP | ± | Diversification in the export orientation will have a negative effect, leading to low supply and demand, while non-diversification will have a positive effect on the region | UNCTAD (2009) |
| Real exchange rates | EXE | ± | Appreciation in the importing country's currency promotes exports from that country and hinders imports | IMF (2009) |

Source: Hellvin and Nilsson (2000) cited in Teweldemedhin and van Schalkwyk (2010).

liberalization, which can have significant effects on changes in trade flows and welfare (Burfisher et al., 2004, cited in Teweldemedhin, 2010).

As reported in Teweldemedhin (2010), notwithstanding the above-mentioned shortcomings of the gravity model, the approach has enjoyed continued popularity due to its two major advantages: Firstly, ease of implementation and superior empirical performance. The data requirements of the traditional model are low and rely on widely available information, while the estimation procedure is straightforward through OLS. Secondly, the empirical success of gravity models in forecasting the volumes of bilateral trade is well documented. Rose (2002), cited in Teweldemedhin (2010), has noted that the gravity-estimated "elasticities of trade with respect to both income and distance are consistently signed correctly, economically large, and statistically significant in an equation that explains a reasonable proportion of the cross country variation in trade." Furthermore, the gravity equation has provided "some of the clearest and most robust empirical findings in economics." In addition, the argument that gravity models cannot clearly trace the links between trade policy and changes in trade flows does not disprove the validity of the gravity equation as long as one interprets the PTA coefficient(s) as the ex-post total effect on trade, reflecting not only the tariff reduction clauses of a PTA but also

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other provisions that may enhance or diminish the liberalization potential of an agreement, along with possible implementation problems. Finally, a number of recent studies have gone a long way towards addressing many of the criticisms of the model.

## RESULTS AND DISCUSSION

### Determinants of export to Africa

Once the necessary statistical test was conducted, the relationship among the variables was estimated to identify factors influencing global trade to Africa. However, applying Ordinary Least Square (OLS) to both the cross-sectional and pooled data created a heteroscedasticity problem. To remedy this problem, Weighted Least Square (WLS) was applied to the cross-sectional (data 2009 from UNCTAD), countries exporting destinations to Africa. The product groups used in the model namely: fresh or chilled beef (HS0201), frozen beef (HS0202) and fresh, chilled or frozen fresh, chilled or frozen mutton, lamb and goat meat (HS0204).

Table 1A to 3A (in the Annexure) shows how the gravity model explains the factors relating to exports to Africa from the rest of the world, based on cross-sectional observation of the year 2009. The overall explanatory power for export determinants range from 22 to 57% in all cases: While what the variables highlighted in red colour show is not significant to be reported (Table 1A to 3A in the Annexure), all other variables highlighted with black colour were found to be statistically significant at the specified level of significance. Furthermore, all variables were found to hold the expected sign.

### GDP per capita of importing African countries

The effect of GDP or GDP per capita is an indication of the growth of the economy and the success of international trade. A higher GDP would most likely affect the coefficient positively (Teweldemedhin and Schalkwyk, 2010). The positive and statistically significant coefficients of the importing country's GDP for the gravity model are consistent with the theory behind the conventional gravity model, suggesting that the size of the economies should enhance the amount of trade between trading partners.

Fresh and chilled beef (HS0201) were found to be statistically significant towards the Southern and West African and the Southern African Development Community (SADC) markets at 5 and 10% respectively. Frozen beef (HS0202) was found to be statistically significant in all regional blocks in Africa. Moreover, it is a highly elastic export to Central and Northern Africa. This suggests that income per capita is much better in these regions and that consumer also prefer frozen beef. However, for sheep and goat meat (HS0204) demand the influence of Gross Domestic Product (GDP) per capita were only found to be significant at 10% in the case of Eastern Africa, Southern and West Africa. This implies that Southern and West Africa show good economic growth that attracts exports, mainly due to the economic growth as a result of oil discovery (examples of countries exporting oil are Ghana and Nigeria in West Africa and Angola in Southern Africa). For example, in this regions a 1% increase in the importing country's GDPc in Southern and West African would create an increase in trade volumes of 0.72 %, thus making exports to the rest of the world more attractive. The results reveal that the demand for meat in Southern and West Africa countries is inelastic. However, considering that food trading in general is inelastic by its nature, this implies that it might now be a good opportunity to further explore Namibian meat as a commodity for increasing export potential to Southern and West Africa. It must be kept in mind that these regions are proportionally among the fastest growing nations in terms of income per capita and population (Table A1 to A3 in the Annexure).

In addition to this, the United Nations report (UN, 2011) shows that the economic growth forecast for sub-Saharan Africa stood at 5.3% in 2011 due to the recovery of the global economy and an improved outlook for oil-producing countries such as Nigeria and Angola. Growth is expected to be driven by continued recovery in the global economy, and domestic demand will continue to play a dominant role in the economic growth of most African countries, which could lead to an increase in GDPc.

The International Monetary Fund (IMF, 2011) report shows that a 7.1% increase in the economic growth for Nigeria, the region's second-largest economy and the continent's largest oil producer, from a previous estimate of 5.7 %. Government spending on infrastructure projects and growth in non-oil industries should have helped to support the economy, which was expected to grow by 6.2% in 2012. Angola, sub-Saharan Africa's second-largest oil producer, was expanded by about 6.7% in 2011 and by 7.5 % in 2012 (IMF, 2011).

The outlook in Kenya, East Africa's biggest economy, was described as 'remains favourable', with 5.2 % growth expected in 2011 and 5.5 % in 2012. While Kenya was benefiting from increased trade with the rest of the region, drought was forecast as possibly damaging agricultural output, thus derailing the growth outlook (IMF, 2011).

The greatest risk to Africa's growth prospects is another slump in the global economy, as most countries on the continent have 'depleted the fiscal space they had created during the pre-crisis period and have not had time to rebuild it' (World Bank, 2011).

The EGM results of this study for GDPc, and the above-mentioned report, reconfirm that Africa is indeed a lucrative market for the Namibian meat industry. There is a need for specific attention to the West African market and Africa at large, considering the following points:

1. Urbanisation and rising incomes have fuelled faster

growth in domestic demand in West African nations.
2. Economic management has improved, while government revenues have been bolstered in recent years by high commodity prices and rapid economic growth in most African countries.
3. Countries such as Uganda and Kenya are growing more rapidly than before, without having to depend on mineral exports.
4. African countries are working toward high levels of sustainable economic growth in order to make significant progress in terms of poverty reduction, to generate productive jobs and livelihoods for the 7 to 10 million young people entering the labour force each year, through commodity exports to achieve substantial poverty reduction and also meet the millennium development goals (MDGs).

***Population***

As shown in the Annexure, population was found to be significant and positive at identified levels (Tables A1 to A3 in the Annexure). For example, fresh and chilled beef (HS0201) were significant towards markets in the Central and Northern Africa, as well as in Southern and West Africa. Frozen meat fresh, chilled or frozen mutton, lamb and goat meat (HS0204) were only significant at 1% in Southern and West Africa, with a positive estimated coefficient; and Frozen beef (HS0202) was found to be significant in all regions (Tables A1 to A3 in the Annexure).

This suggests that population is extremely important when it comes to an attractive export potential. A densely populated nation means a greater demand for protein commodities such as meat. As mentioned previously, the West African countries of Nigeria and Ghana and the Southern African country of Angola have seen an increase in population in proportion to a reduction in income inequality. This evidence, combined with the results of the EGM used in this study, validate or reconfirm that Namibia is in good standing to extend or explore African markets.

***Distance***

A country that lies geographically further from exporting countries is expected to influence the profitability and as a result such a country becomes less attractive as export destination, particularly due to transport costs. The coefficients indicate that this is indeed the case. For example, in the case of fresh and chilled beef (HS0201) export, distance was found to be significant and negative estimated coefficient with highly elasticity for all cases/regions, with the exception of the East African market (Table 1A to 3A in the Annexure). This implies transportation cost is a major constrain for export capacity; as far from major trading partners will adversely affect trade volume. The poor infrastructure in most African countries and the bureaucratic red tape involved in clearing goods through the ports could aggravate the matter further or discourage exports to Africa. Since Namibia is adjacent to many export destination countries in Africa, other highly competitive meat-exporting countries may be discouraged by distance, which constitutes a good opportunity for Namibia to increase export volumes. This could be a good indicator for Namibia, since being closer in distance is an important factor in determining trade (Figure A1 in the Annexure).

***Exchange rate***

The magnitude effect of this coefficient is relatively smaller than the other variables. Rapid short-term depreciations of local currency will overshoot the potential export although over the long term the exchange rate effect becomes less severe compared with the other variables. In addition to this, a result this variable was not significant in most cases, since the data is in cross section and it is very difficult to see the impact in one year. To derive an inclusive implication on this variable, it requires a longer period for an observation experiment.

The dummy variables “Africa and EU export origin” and the dummy variable “trading within African nations” were found not to be significant in explaining exports, whereas the “EU” dummy variable was found to be significant to influence African market, implying that trade liberalisation with the EU region is an important variable in explaining trade. The “EU” dummy variable (export origin from EU) appeared to be significant in all products and regions, with relatively higher elasticity with negative estimated coefficient. The negative relationship might be due to the fact that trade liberalisation and trade agreement between the EU and Africa will discourage exports potential exports originating from other exporting nations, although Oceania seems to have a comparative advantage in frozen beef exports to Africa (Tables A1 to A3 in the Annexure).

**Determinants of meat exports to Asian countries**

***GDP per capita of importing Asian countries***

This variable is significant in all regions for all products at specified level and positively related (with the exception of South Asia). For example, estimated coefficients show highly elastic at 1.54, 1.03, and 1.29 for fresh or chilled beef (HS0201), frozen beef (HS0202) and fresh, chilled or frozen mutton, lamb and goat meat (HS0204), respectively (Table A4 to A6 in the annexure). This implies that a smaller change in income in this region would lead to a greater change in attracting export potential to the region. For example, the largest importer of fresh meat in Central and East Asia is Japan at 83%,

followed by Korea at 13% and China and Hong Kong at only 4%. This clearly shows that a higher income society can have a major influence. However, as a result of the location proxy, Oceania (Australia and New Zealand) and North America are the largest trading partners, accounting for 78 and 21%, respectively, of the total imports to Asia (Figure A2 in the Annexure).

Although Japan seems a promising prospective market for Namibian meat exports, the Japanese market will require much exploration. As the model shows, a 1% increase in mean income would attract an additional export potential of 1.54% to Central and East Asia. For example, Chinese consumers tend to be conservative and price sensitive. Exceptions are spending on education, medical care, gifts, entertainment and children. Hence, for high-end food products, the most potential exists in the hospitality market. Food safety has become a major issue, especially in the urban areas. The notion that food can be unsafe has increased and is more prevalent amongst higher-income consumers, who rely more on processed and pre-packed foods. Hence, these consumers place a premium on famous brands or retailers with a solid reputation. Furthermore, this market segment is more health and nutrition conscious. Urban households' expenditure on food has doubled in the last five years. Expenditure on meat has risen sharply, whereas the expenditure on grains has fallen (USDA, 2009).

The strengths and opportunities for meat products in the Chinese food market can be summed up as follows (USDA, 2009):

1. Chinese consumers spend nearly half of their disposable income on food and beverages.
2. Imported goods are generally perceived as safe and high in quality.
3. New markets for imported foods are arising in fast-growing cities throughout China.
4. Overseas retail chains are expanding quickly, offering more imported products and house brands.
5. Food is an essential part of Chinese culture and social life. Key life events revolve around food and little expense is spared.
6. There is a very large market with millions of people joining the middle-class each year.
7. Trends in the food market can shift *en masse*.
8. Chinese consumers prefer fresh foods.
9. Increases in personal ownership of refrigerators and microwaves have boosted the sales of frozen and heat-to-eat products.
10. Small, 'economy' size, attractive, and branded food packaging is preferred.

***Population***

This was found to be significant at the specified significance level, positive and inelastic in all regions, with the exception of West Asia for fresh and frozen beef and South East Asia for sheep or goat meat. Since population alone is not the determinant factor influencing exports, but should rather be interpreted in conjunction with the income level. However, this is an indication that nations with denser populations are attractive as export destinations. It is important to take note again that it is not only population growth that matters, but also economic growth (Table A4 to A6 in the annexure).

In the Asian market, despite the significant increase of meat consumption, there still exists a huge potential for expansion as the per capita consumption of the 1.3 billion people is relatively low. In urban areas the per capita annual meat consumption is about 37 kg, and about 18 kg in the rural areas, for example as in China. This, together with the optimistic economic prospects and increasing consumer expenditure, provides a good outlook for meat exports to China (USDA, 2009).

***Distance***

With the exception of Central and East Asia, all regional blocs were found not to be significant for fresh or chilled beef HS0201. For frozen meat, South Asia and West Asia were found to be significant at 1% and had negative coefficients at 1.40 and 0.95, respectively. This implies distance has greater impact to influence trading to these regions. Sheep or goat meat, on the other hand, was found to be significant at 10% with an estimated coefficient of 0.64 in West Asia (Table A4 to A6 in the annexure).

It is important to interpret the above gravity model results for distance in conjunction with other factors that influence the beef market. For example, the Asia market (specifically China) is a moderately accessible market with regard to transport. The shipping time for a 40 ft reefer from Namibia is up to 69 days (including domestic time). Of these, 45 days are international shipping time. However, these transport times impede the export of fresh and chilled meat products. In addition to this, in China there is a 12% import duty on frozen, bone-in sheep meat and a 15% import duty on frozen, boneless sheep meat. Goat meat faces an import levy of 20%, whereas animal fats are subject to an import duty of only 4%. Non-tariff barriers mainly revolve around import regulations and food safety standards.

***Exchange rate***

This variable was found to be significant in Asia and Southeast Asia at 1% with an inelastic behaviour estimated coefficient, that is, one unit of change in the exchange rate would lead to less than one unit of change in export attraction. The other regions were found to be

not sufficiently significant to influence the dependent variable. However, for frozen beef and sheep or goat meat, exchange rate was found to be significant in South East Asia and West Asia (Table A4 to A6 in the annexure). The theoretical literature on exchange rate, beginning with Clark (1973), as cited in Tang (2011), asserts that a risk-adverse firm facing increased exchange rate volatility will reduce its exports due to the uncertainty in its future profitability. Other models show that the negative relationship between exchange rate volatility and trade may not always hold under different conditions. For example, the presence of hedging instruments or accessibility to mature forward markets can alleviate the impact of exchange rate volatility on trade. On the other hand, an opposite (positive) relationship can exist when highly risk-adverse firms faced with volatile exchange rates increase their exports due to stronger income over substitution effects, and when high costs are involved in entering and exiting export markets.

As a result, Namibia recently signed an agreement with its Chinese counterpart, paving the way for quota-free access to the Asian market for locally produced and processed beef, mutton, fish, and also fruit. The agreement between Namibia and China will be valid for five years and will be eligible for renewal (The Namibian newspaper, 2011).

## Conclusion

This paper has evaluated, analysed and classified the significance of determinants affecting meat exports globally, using the extended gravity model. Consideration was also given to investigating the impact of income, per capita income, distance, exchange rates and dummy variables for export origin from the specific regional blocs' supplies or countries' trading partners to capture the impact of trade agreements or preference on the trade volumes with the specific country or region. The model found all variables to be significant at the specified significance level with the expected sign in most cases.

The results of the EGM have several important policy implications for Namibia. Firstly, trade agreements – whether implemented unilaterally or bilaterally – will enhance potential trade flows between Namibia and other countries or regions. It is also important to protect and advocate product growth within the context of fair agreement. Secondly, from an export promotion standpoint, distance in the model results showed that the importing countries' per capita income is elastic and significant in determining exports in most cases. It is therefore important for Namibia to consider further detailed studies into the behaviour and consumer preferences of the specific markets, as high per capita income can realise export potential.

Within Africa, GDPc was found to be positively related and significant in Southern and Western Africa for fresh or chilled beef (HS0201), implying export opportunities. Fresh or chilled beef (HS0201) was found to be significant in all cases, while goat and sheep meat, fresh, chilled or frozen mutton, lamb and goat meat (HS0204) were only significant in East Africa, showing that product preferences with relation to trade differ within Africa. Population was also found to be an important variable influencing meat trade within Africa; population is positively related to the dependent variable. This suggests that a higher income per capita is a major indicator of potential as an export destination and that a densely populated nation will have a greater demand for protein commodities such as meat, although a larger population can both increase and decrease trade, depending on GDP per capita.

In the second category, distance and exchange rate, as well as regional trade agreement influence on meat trading in Africa, were found to be significant at the specified level in most cases. The first two variables (distance and exchange rate) were found to be negatively related to meat export capacity to Africa and distance is elastic. Poor infrastructure in most African countries and the bureaucratic red tape involved in clearing goods through the ports could further discourage exports to Africa. However, Namibia's geographic location could be a competitive advantage over other highly competitive meat-exporting countries.

In East Asia, income per capita was found to be significant at 1% and highly elastic (with a coefficient of 2.29), suggesting it as a good export destination. The biggest importer of meat in East Asia is Japan, accounting for 83%, followed by Korea (13%) and China and Hong Kong at only 4%. Given this, Japan could be a good market, considering the higher income of its society. However, Oceania (Australia and New Zealand) and North America are the main trading partners with an export capacity of 78 and 21 %, respectively. Although Japan seems like a good prospective market for meat exports, it is advisable to explore the market further. The recent earthquake and tsunami in Japan disrupted global supply chains, and high oil prices slowed consumption in all advanced economies. In terms of Namibia's ability to compete with Oceania and North America, once the Japanese economy has recovered, Namibia will have a good opportunity to acquire a market share.

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## ANNEXURE

**Table A1.** Determinants of fresh beef export to Africa (code 0201): EGM approach.

| Coefficients | Africa | | East Africa | | Central and Northern Africa | | Southern and West Africa | | SADC | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. error | B | Std. error | B | Std. error | B | Std. error | B | Std. error |
| GDPc | 0.42** | (0.08) | 0.10 | (0.28) | 0.59 | (0.49) | 0.72** | (0.35) | 0.72*** | (0.38) |
| POP | 0.18** | (0.08) | 0.05 | (0.28) | 0.45*** | (0.28) | 0.39* | (0.13) | 0.21 | (0.18) |
| DIST | -1.07* | (0.52) | -1.08 | (0.75) | -1.29*** | (0.64) | -2.47** | (0.60) | -2.02** | (0.77) |
| AFRI | -0.095 | (0.63) | -0.05 | (1.23) | 0.67 | (1.11) | -0.66 | (0.90) | 0.40 | (1.09) |
| EU | -1.02** | (0.36) | -1.44 | (0.95) | -0.75 | (0.92) | -1.40** | (0.67) | -1.69*** | (0.98) |
| SUPP | 0.24* | (0.09) | 0.40** | (0.16) | 0.30** | (0.15) | -0.04 | (0.130) | 1.14 | (0.16) |
| EXE | -0.25* | (0.19) | -0.47** | (0.28) | 0.16 | (0.18) | -0.13 | (0.12) | -0.35 | (0.22) |
| (Constant) | 10.96* | (3.94) | 16.5** | (7.3) | 5.35 | (8.7) | 21.9* | (6.40) | 18.7** | (8.7) |
| $R^2$ | 0.53 | | 0.61 | | 0.57 | | 0.75 | | 0.71 | |
| Adjusted $R^2$ | 0.28 | | 0.37 | | 0.33 | | 0.57 | | 0.50 | |
| ANOVA | 0.00 | | 0.019 | | 0.03 | | 0.00 | | 0.03 | |
| F-test | 6.87 | | 2.85 | | 2.56 | | 6.91 | | 4.15 | |
| No. of observation | 133 | | 41 | | 44 | | 44 | | 36 | |

*, ** and *** significant level at 1, 5 and 10% respectively; Standard error indicated at the parenthesis.

**Table A2.** Determinants of frozen beef export to Africa (code 0202): EGM Approach.

| Coefficients | Africa | | East Africa | | Central and Northern Africa | | Southern and West Africa | | SADC | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. error | B | Std. error | B | Std. error | B | Std. error | B | Std. error |
| GDPc | 0.66* | (0.10) | 0.77* | (0.16) | 1.09* | (0.29) | 0.29*** | (0.18) | 0.92* | (0.25) |
| POP | 0.33* | (0.06) | 0.35* | (0.11) | 0.91* | (0.20) | 0.24** | (0.11) | 0.39* | (0.14) |
| DIST | -0.47*** | (0.25) | -1.59* | (0.47) | 0.26 | (0.40) | -0.80*** | (0.48) | -1.73* | (0.61) |
| EXE | -0.14* | (0.04) | -0.21* | (0.09) | 0.01 | (0.10) | -0.14** | (0.07) | 0.05 | (0.14) |
| SUPP | 0.31* | (0.06) | 0.34* | (0.13) | 0.68* | (0.15) | 0.21* | (0.08) | 0.18 | (0.13) |
| D1. AFRI | -0.90*** | (0.52) | -2.54* | (0.89) | 0.24 | (0.95) | -1.12 | (1.09) | -2.40** | (1.16) |
| D2. EU | -1.34* | (0.31) | -1.49* | (0.50) | -1.18** | (0.56) | -1.23** | (0.53) | -1.77* | (0.70) |
| D2. L .AM | 0.05*** | 0.30 | -0.33 | (0.55) | -0.68 | (0.47) | 0.02 | (0.51) | 0.38 | (0.65) |
| D4. Oceana | -1.68* | (0.44) | -1.09 | (0.72) | -3.66* | (0.72) | -1.45*** | (0.85) | -0.59 | (0.85 |
| (Constant) | -3.08 | (2.76) | 5.86 | (5.23) | -26.54* | (7.00) | 4.48 | (4.61) | 5.74 | (7.16) |
| $R^2$ | 0.37 | | 0.42 | | 0.57 | | 0.22 | | 0.37 | |
| Adjusted $R^2$ | 0.36 | | 0.37 | | 0.53 | | 0.16 | | 0.30 | |
| ANOVA | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| F-test | 21.95 | | 8.24 | | 14.55 | | 3.59 | | 4.87 | |
| No. of observation | 341 | | 111 | | 107 | | 121 | | 83 | |

*, ** and *** significant level at 1, 5 and 10% respectively; Standard error indicated at the parenthesis.

**Table A3.** Determinants of sheep and goat meat export to Africa (0204): EGM approach.

| Coefficients | Africa | | East Africa | | Central and Northern Africa | | Southern and West Africa | | SADC | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. error | B | Std. error | B | Std. error | B | Std. error | B | Std. error |
| GDPc | 0.59* | (0.13) | 0.27*** | (0.17) | 0.44 | (0.29) | 0.39*** | (0.21) | -0.08 | (0.08) |
| POP | 0.30* | (0.07) | 0.19 | (0.13) | 0.25 | (0.24) | 0.27* | (0.09) | -0.09 | (0.07) |
| DIST | -0.80** | (0.33) | -0.59*** | (0.35) | -0.89 | (0.70) | -0.99*** | (0.55) | -0.01 | (0.45) |

**Table A3.** Contd.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SUPP | -0.06 | (0.05) | 0.08 | (0.08) | -0.12 | (0.11) | -0.080 | (0.07) | -0.13 | (0.10) |
| EXE | 0.33* | (0.07) | 0.13 | (0.14) | 0.33** | (0.13) | 0.20*** | (0.11) | 0.04 | (0.05) |
| D1. AFRI | -1.29** | (0.64) | -1.94** | (0.88) | -2.44** | (1.01) | 0.43 | (1.07) | -0.97 | (0.66) |
| D2. EU | -1.50* | (0.43) | -1.68*** | (1.03) | -2.42* | (0.69) | 0.57 | (0.81) | -2.16* | (0.57) |
| L .AM | -0.49 | (0.53) | 2.74 | (2.41) | -1.66** | (0.72) | 0.42 | (1.08) | 1.58 | (1.15) |
| Oceana | 0.46 | (0.53) | 2.22 | (1.90) | -1.12 | (0.83) | 3.37* | (1.04) | 2.30** | (1.06) |
| (Constant) | -0.17 | (3.49) | 0.86 | (2.20) | 4.81 | (8.88) | 2.68 | (5.53) | 4.75 | (5.11) |
| $R^2$ | 0.42 | | 0.61 | | 0.42 | | 0.51 | | 0.61 | |
| Adjusted $R^2$ | 0.39 | | 0.50 | | 0.35 | | 0.44 | | 0.54 | |
| ANOVA | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| F-test | 15.19 | | 5.97 | | 5.70 | | 7.29 | | 8.42 | |
| No. of observation | 199 | | 44 | | 80 | | 73 | | 57 | |

*, ** and *** significant level at 1, 5 and 10%, respectively; Standard error indicated at the parenthesis.

**Table A4.** Determinants of fresh beef export to Asia (code 0201): EGM approach.

| Coefficients | Asia | | Central and East Asia | | South Asia | | South East Asia | | West Asia | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. error | B | Std. error | B | Std. error | B | Std. error | B | Std. error |
| GDPc | 0.79* | (0.12) | 2.29* | (0.35) | -0.29 | (0.74) | 1.54* | (0.34) | 0.44** | (0.21) |
| POP | 0.34* | (0.09) | 0.68* | (0.16) | 0.46*** | (0.27) | 0.47** | (0.34) | 0.27 | (0.18) |
| DIST | -0.56** | (0.25) | -1.09*** | (0.68) | -0.71 | (0.67) | -0.43 | (0.51) | -0.50 | (0.40) |
| EXE | 0.09* | (0.03) | 0.17 | (0.16) | 0.36 | (0.46) | 0.45* | (0.11) | 0.50 | (0.07) |
| SUPP | 0.41* | (0.07) | 0.32* | (0.23) | 0.68** | (0.27) | 0.50* | (0.13) | 0.54* | (0.09) |
| Asia. dummy | 1.7* | (0.61) | | | 2.68 | (1.73) | 3.41* | (1.24) | 1.98* | (0.60) |
| L. Amer. dummy | 1.2*** | (0.72) | | | 1.94 | (1.94) | 2.29** | (1.10) | 1.22** | (0.63) |
| EU. dummy | -1.70* | (0.70) | | | | | | | -2.18* | (0.64) |
| OCE. dummy | 2.31* | (0.70) | 4.06* | (0.77) | -1.50 | (1.71) | 4.12* | (0.71) | 1.35** | (0.66) |
| N. Amer. dummy | 0.96 | (0.78) | 3.18* | (0.83) | | | 2.75* | (0.84) | | |
| (Constant) | -4.54 | (2.99) | -19.12** | (7.53) | 12.04 | (10.2) | -18.9** | (7.7) | 2.04 | (4.45) |
| $R^2$ | 0.45 | | 0.75 | | 0.61 | | 0.67 | | 0.45 | |
| Adjusted $R^2$ | 0.43 | | 0.72 | | 0.40 | | 0.61 | | 0.41 | |
| ANOVA | 0.00 | | 0.00 | | 0.04 | | 0.00 | | 0.00 | |
| F-test | 22.38 | | 20.6 | | 2.85 | | 10.71 | | 12.37 | |
| No. of observation | 279 | | 53 | | 22 | | 56 | | 145 | |

*, ** and *** significant level at 1, 5 and 10% respectively; Standard error indicated at the parenthesis.

**Table A5.** Determinants of frozen beef export to Asia (code 0202): EGM model approach.

| Coefficients | Asia | | Central and East Asia | | South Asia | | South East Asia | | West Asia | |
|---|---|---|---|---|---|---|---|---|---|---|
| | B | Std. error | B | Std. error | B | Std. error | B | Std. error | B | Std. error |
| GDPc | 0.43* | (0.10) | 0.60** | (0.29) | -0.33 | (0.45) | 1.03* | (0.28) | 0.34* | (0.14) |
| POP | 0.18** | (0.08) | -0.04 | (0.16) | -0.28*** | (0.17) | 0.87* | (0.21) | 0.07 | (0.13) |
| DIST | -0.69* | (0.19) | 0.07 | (0.44) | -1.40* | (0.44) | -0.80 | (0.44) | -0.95* | (0.29) |
| SUPP | 0.07*** | (0.04) | 0.05 | (0.14) | 1.10* | (0.20) | 0.15 | (0.08) | -0.06 | (0.06) |
| EXE | 0.47* | (0.05) | 0.12 | (0.09) | -0.03 | (0.11) | 0.80* | (0.12) | 0.68* | (0.08) |
| D1. ASIA | 1.02 | (1.15) | 5.68 | (4.70) | 1.37*** | (1.79) | | | 0.53 | (1.25) |
| D2. L. AM | 1.10 | (1.22) | 5.08 | (4.74) | 5.44** | (2.16) | -1.12 | (0.95) | 0.01 | (1.40) |
| D3. AFRI | 1.29 | (1.41) | 3.26 | (5.18) | | | 1.83 | (1.45) | 0.25 | (1.57) |
| D4. EU | -1.03 | (1.17) | 2.73 | (4.73) | 3.59*** | (1.85) | -3.89* | (0.95) | -1.97*** | (1.25) |
| D5. OCEANA | 1.06 | (1.24) | 7.55 | (4.78) | 3.08 | (2.21) | -1.18*** | (0.73) | -0.55 | (1.45) |

**Table A4.** Contd

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| D6. N.AM | 0.85 | (1.25) | 6.90 | (4.79) | 4.20*** | (2.28) | -1.06 | (1.01) | -1.10 | (1.42) |
| (Constant) | -0.80 | (2.33) | -4.59 | (6.99) | 17.71* | (6.20) | -18.55* | (6.21)) | 2.40 | (3.54) |
| $R_2$ | 0.36 | | 0.50 | | 0.76 | | 0.61 | | 0.45 | |
| Adjusted $R^2$ | 0.34 | | 0.41 | | 0.69 | | 0.57 | | 0.42 | |
| ANOVA | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| F-test | 19.54 | | 5.52 | | 10.92 | | 13.01 | | 13.10 | |
| No. of observation | 400 | | 72 | | 45 | | 92 | | 188 | |

*, ** and *** significant level at 1, 5 and 10% respectively; standard error indicated at the parenthesis.

**Table A6.** Determinants of sheep and goat meat export to Asia (code 0204): Extended gravity model approach.

| | Asia | | Central and East Asia | | South Asia | | South East Asia | | West Asia | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Coefficients** | **B** | **Std. error** | **B** | **Std. error** | **B** | **Std. error** | **B** | **Std. error** | **B** | **Std. error** |
| GDPc | 0.62* | (0.12) | 1.88** | (0.81) | -0.22 | (0.40) | 1.29* | (0.39) | 0.47* | (0.17) |
| POP | 0.29* | (0.09) | 0.86** | (0.35) | -0.25*** | (0.15) | 0.36 | (0.33) | 0.77* | (0.16) |
| DIST | -0.01 | (0.23) | -1.52 | (1.31) | 0.16 | (0.65) | -0.59 | (0.89) | -0.64*** | (0.34) |
| SUPP | 0.01 | (0.05) | -0.44* | (0.11) | 0.27 | (0.22) | 0.31** | (0.13) | -0.08 | (0.07) |
| EXE | 0.40* | (0.07) | 0.08 | (0.23) | 0.18 | (0.12) | 0.48* | (0.14) | 0.57* | (0.09) |
| D1. ASIA | | | -3.18** | (1.41) | | | -0.40 | (1.48) | | |
| D2. L. AM | -0.85 | (0.58) | -2.60 | (1.64) | -0.17 | (1.25) | -0.58 | (1.65) | -0.45 | (0.70) |
| D3. AFRI | -0.61 | (0.56) | | | | | -0.99 | (2.37) | -0.71 | (0.55) |
| D4. EU | -2.38* | (0.37) | -4.37* | (0.98) | 0.67 | (1.06) | -2.47** | (0.97) | -3.24* | (0.43) |
| D5. OCEANA | 0.02 | (0.49) | | | 0.09 | (1.47) | | | 0.26 | (0.64) |
| D6. N.AM | -2.79* | (0.69) | -5.33* | (1.86) | 1.55 | (1.32) | -2.15 | (1.40) | -3.22 | (0.96) |
| (Constant) | -7.97* | (2.58) | -8.80 | (9.43) | 5.81 | (6.61) | -1.2.45 | (9.33) | -10.13** | (4.27) |
| $R_2$ | 0.47 | | 0.85 | | 0.38 | | 0.57 | | 0.58 | |
| Adjusted $R^2$ | 0.44 | | 0.80 | | 0.16 | | 0.47 | | 0.55 | |
| ANOVA | 0.00 | | 0.00 | | 0.14 | | 0.00 | | 0.00 | |
| F-test | 22.50 | | 16.72 | | 1.72 | | 5.34 | | 18.93 | |
| No. of observation | 269 | | 36 | | 34 | | 50 | | 146 | |

*, ** and *** significant level at 1, 5 and 10% respectively, Standard error indicated at the parenthesis.

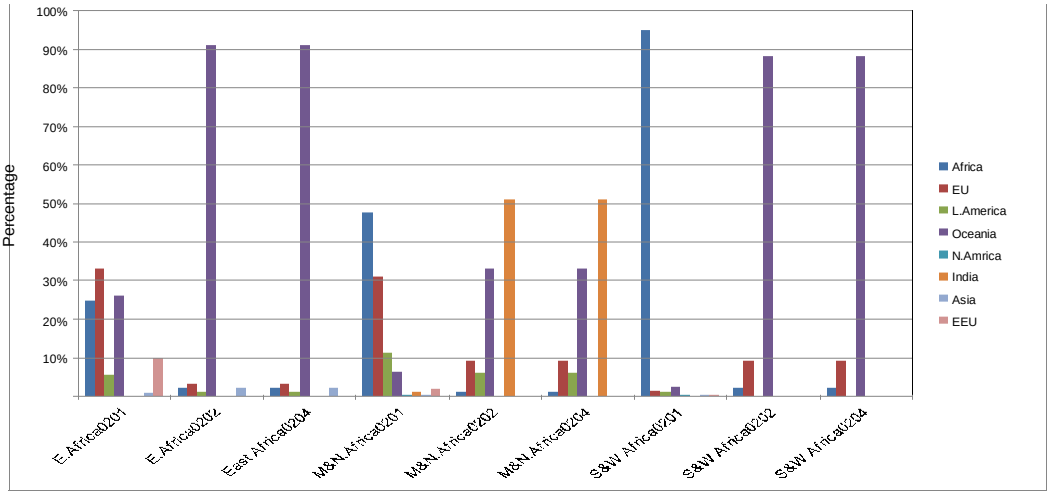


**Figure A1.** Distribution of meat export destinations to Africa from different regions; Source UNCTAD (2009).

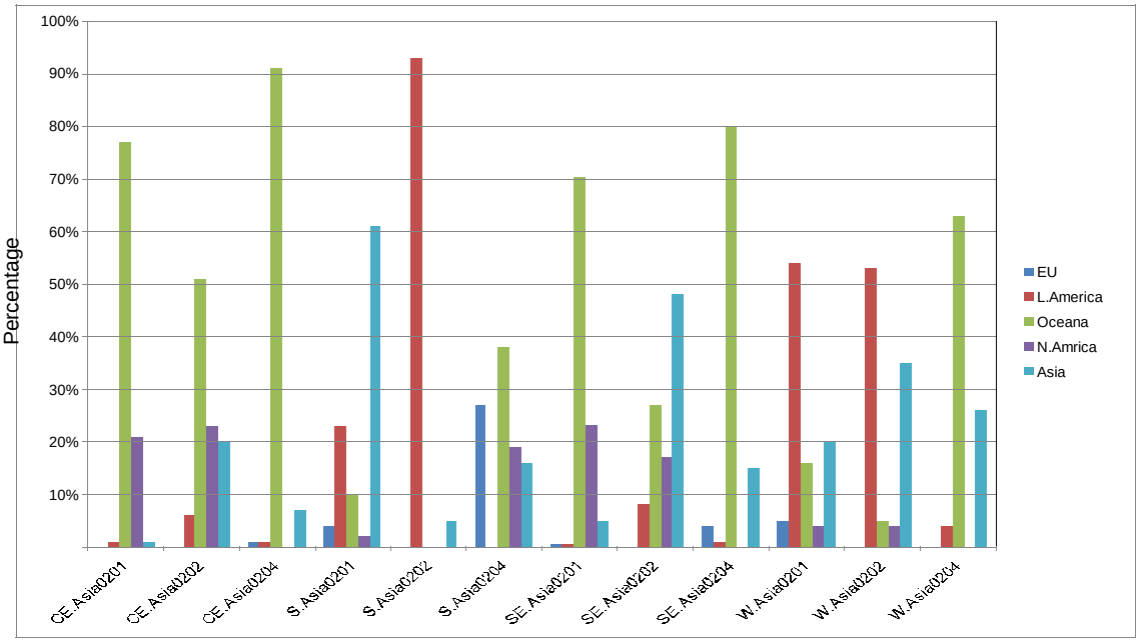


**Figure A2.** Distribution of meat export destinations to Asia from different regions; Source UNCTAD (2009).