

# ***“New” Turkey, “New” Africa: A Gravity Analysis***

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## **Abstract**

Turkey’s “new” interest in the African continent has reached a level that merits academic investigation. There have been few if any robust study analyzing the social and economic dimensions of Turkey-Africa relations by employing technical methods. This paper aims to fill this gap by using a well established model within the discipline of international economics known as the “gravity model”. This model determines Turkey’s gravitational dynamics between specific African countries by examining pull and push factors. At the outset, however, a note of caution in relation to the use of this technical method is in order. When conducting technical research along this line, there are a number of potential problems to keep in mind, one of which relates to the reliability and availability of data. This problem is probably the main reason for the scarce number of technical analyses in this area.

***Keywords:*** *Gravity Model, African Economies, Turkey.*

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## **INTRODUCTION**

The paper is organised as follows: the first section establishes the evolution, breadth and scope of Turkey-Africa relations. The following section presents the gravity model and its operation as well as data specification. The next section presents the findings of the study and suggests alternative policy options to pave the way forward for a more advanced Turkey-Africa relations. The paper ends with a conclusion.

## **TURKISH INTEREST IN AFRICA: HISTORICAL BACKGROUND**

Turkey’s recent interest in the African continent has been receiving some attention from the media and community of commentators both in Turkey and abroad. It is unfortunate, however, that popular coverage of Africa, particularly in the wake of the so-called “Arab Spring”, is full of misconceptions and unwarranted prejudices. In the Turkish press, images of the African continent revolve mostly around the concepts of poverty, famine, disease and violence. The African experience with development is widely viewed as a tragedy. Addressing these misconstrued views is not within the scope of this paper, though it is necessary to stress that academic contributions to developing a proper understanding of the continent that goes beyond a pessimistic view have been flimsy to date.

The Turkish mass media, mostly mimicking their Western counterparts, attempts to portray Turkish-African interactions through the prism of borrowed concepts, mostly with negative connotations (Aybar, 2006).

In this sense, African problems are viewed in pathological terms. Henceforth, developing a more balanced and objective view on the African continent requires a degree of academic endeavour that studies its problems as the outcome of the type of integration it has experienced within the global economic system. (Sender, Cramer, Oya, 2005)

The African continent has witnessed a wave of success as far as certain aspects of development are concerned, particularly in the areas of education, healthcare and infrastructure improvement (Hailu, 2008). These successes owe much of their realization to the independence movements of the 1960s, which brought about a promotion of these developmental areas as national priorities. However, it is imperative to note that some developmental outcomes have produced a mixture of success stories, as some countries have proven to be more successful than the others. In the meantime, old colonial ties have been re-established in a more innovative manner, which has given rise to a set of literature studying the “new-colonialism” (Glyn, 2006). More recently high growth rates in the People’s Republic of China (PRC) and India and the changing nature of production across the globe has spurred an increase in demand for African minerals and raw materials. The Chinese demand for African export items has grown over tenfold in the last decade. In return, the Chinese presence in Africa has grown considerably, as the Chinese are engaged in funding and building infrastructure projects (Knowledge@Wharton, 2016). It is also estimated that there are more than one million Chinese citizens, mainly from the poorer regions of the country, who have now emigrated to

Africa, settled even in small villages and engaged in trade, construction works and small scale businesses. This trend would have added strength to Chinese soft power if not for the nascent accusations by local communities that the Chinese are exploiting and plundering the continent in the same way as the old colonial powers. The integration of the “de-linked” African continent into the world economy has hence taken a new turn (Brautigam, 2015).

For instance, Angola, Mozambique and Rwanda – all of which are recovering from civil wars – have achieved high growth rates within the last decade. Mozambique, the largest coal exporter in the world, has become an energy hub after the discovery of natural gas reserves. Mozambique is also experiencing a construction boom. Oil discovery in Kenya has led to a rise in inward FDI. In fact, such developments are widespread across almost the entire continent (UNCTAD, 2014). In 2015, six of the world’s top 10 fastest growing economies were located in Africa. African economic growth on average in 2012 was 5.3%, and it was 5.6% in 2013, according to World Bank reports in 2013 and 2015. These positive developments have led to a rise in infrastructure investments, increased consumer demand and portfolio investments, particularly in the communications and finance sectors. In short, Africa is now offering attractive prospects for the rest of the world as it re-enters the world trade and economic sphere.

It can be argued that Turkey’s recent interest in the continent is also a part of this new type of integration. In this regard, Africa offers

promising prospects for Turkish industry and investments. At this stage of her development, Turkey can no longer ignore the opportunities and mutual benefits that Africa can offer. However, this is not to suggest that such an interaction is free of problems. The positive economic growth rate in Africa does not trickle down to alleviate widespread poverty. Although high economic growth rates have given rise to a middle class driven by strong demand and consumption habits, poverty is widespread and presents itself as the main developmental challenge on the continent. Hence, one of the important problem areas is the prevailing poverty, which also takes its toll on Turkey's involvement on the continent. Confronting such a problem necessitates that Turkey become a donor country, allowing it to ease its entry into the continent (Hausmann and Lungsgaarde, 2015).

In order to uncover the complex nature and scope of Turkey-Africa relations in the broader context of the existing world economic division of labour, it is necessary to investigate outcomes separately for each interacting partner. In this sense, tracing back relations to their historical roots helps us pinpoint the underlying economic processes that drive current economic and social interactions between Turkey and the continent of Africa.

The historical roots of Turkey-Africa relations date back to the Ottoman Empire, which developed political, economic and cultural ties with the continent. The last of the Ottoman territory on the continent, today's Libya, was lost in 1913. The Turkish presence in North Africa left

behind a large Turkish population as well as cultural and religious ties. However, it was not only North Africa where Ottomans extended their economic and political interests but also they were present in sub-Saharan Africa. Their presence can be detected today in Uganda, Sudan, Senegal, Mali, Mozambique, South Africa, Ethiopia, Kenya, and Central Africa. Although Turkey-Africa relations entered a latent period after the foundation of the Turkish Republic in 1923, the first Turkish embassy on the continent was opened in 1926 in Ethiopia, which was the only independent African country at the time. Turkey took a stand in support of Ethiopia against Italian aggression during the Italian occupation of the country. After the Second World War, as a result of rapprochement with NATO and the Western camp and formulation of domestic and foreign policies around the Truman Doctrine and the Marshall Plan, Turkey remained distant from African affairs during cold war. By following pro-Western policies during African independence struggles, Turkey further opened a gap between itself and Africa. It was only in 1955 that Turkey started to shift its position on Africa and began supporting the de-colonisation process, which included defending the admission of the African countries to the United Nations. (Hazar, 2003)

More recently, in the “new world order” that ensued after the collapse of the USSR, Turkish foreign policy has shifted from a uni-dimensional policy to a multi-dimensional one. The new Turkish security architecture, based on the Greater Middle-Eastern Project (GMP), has led Turkey to show some interest in African affairs. The end of Cold

War in 1989, the first Iraq War in 1992 and ensuing developments in the Middle East required Turkey to shift its security emphasis in Africa beyond the Sahara. In line with the shift in security concerns, a new operational plan known as the “Opening Up to Africa Policy” plan was developed in 1998. Since the beginning of the 21st century, as Africa began receiving interest from a variety of countries (such as China and India), Turkey has also heightened its interest in the African continent (hazar, 2003). This interest reached its peak during the Turkey-Africa Summit in 2008, which 44 African heads of state attended. Today, Turkey’s interest in Africa is strategic, and the African Union (AU) has also declared Turkey as a strategic partner (Aybar, 2009).

The “Opening Up to Africa Policy” encouraged mutual governmental visits, aimed to increase the number of Turkish embassies on the continent and sought to develop close relations with local and international organizations. It also proposed to explore ways to extend humanitarian aid as well as realize technical and scientific collaboration. Since then, Turkey has achieved a number of successful outcomes. In addition to becoming a member of the African Development Bank (ADB) in 2005, Turkey also became a member of the AU in the same year (Aybar, 2006).

Turkey declared 2005 as the “Africa Year” and organized a series of events celebrating African culture, history and arts. Then-Prime Minister Recep Tayyip Erdoğan visited Ethiopia and the Republic of South Africa in 2005 and Sudan in 2006. He also attended the AU

Summit in 2007. More recently, in 2016, now President of the Republic Recep Tayyip Erdoğan visited three West African countries: Nigeria, Ghana and Guinea. In May 2016, further set of visits to Uganda, Kenya and Somalia took place (Aglionby, 2016). Turkey’s active Africa opening policy helped Turkey to secure sufficient support in the United Nations to assume a role in the UN Security Council during the 2009-2010 cycle.

The number of Turkish embassies on the continent has risen from 12 in 2009 to 39 in 2016. Turkey has decided to grant tertiary level education scholarships to a large number of African students<sup>2</sup>. Turkey is also seen as a destination country for many African migrants, whose numbers are increasing dramatically. In Africa, there exist a large Turkish diaspora.

Turkey also has become one of the largest emerging donor economies alongside India and Brazil. The Turkish Cooperation and Development Agency (known by its Turkish acronym of TİKA) was launched by the government during the 1990s and has expanded its operations into Africa. As of 2016, according to official figures TİKA has fifteen offices operating in sub-Saharan Africa (TİKA, 2016). Table 1 highlights the volume of Turkish aid part of which goes to Africa. TİKA has opened branches in Sudan, Ethiopia and Senegal and engaged its efforts in a wide variety projects in the areas of education, agricultural

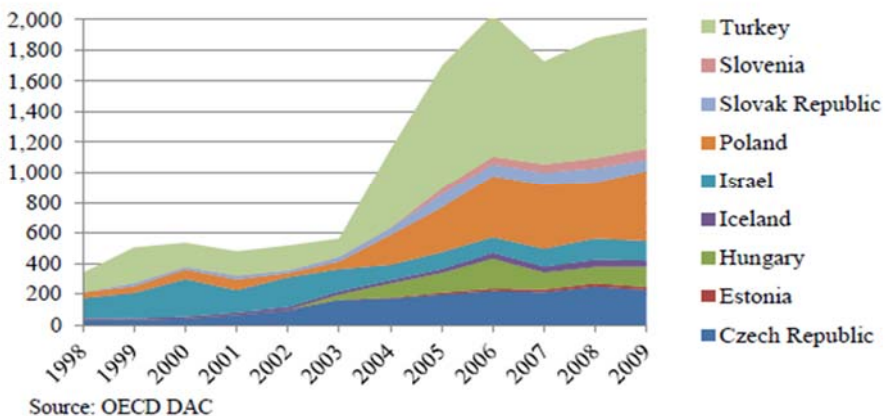
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<sup>2</sup> In 2006, Kadir Has University inaugurated an African Research Center, the first of its kind in Turkey. Today, nearly fifteen such Centers are in operation, including the one at Istanbul Aydın University. That same year, the community of Afro-Turks launched their own association, known as “Afrikalılar” (Africans), and this association took initiative to revitalize traditional Afro-Turk festivities, known as “Dana Bayramı” (Feast of the Beast).



development, irrigation and healthcare. In addition to TIKA's efforts, Turkey has carried out defense related collaboration with countries like Burkina Faso, Ethiopia, Gambia, Democratic Republic of Congo, Mali and Senegal.

**Table 1.** *The rise in Turkey's aid to developing countries*



It is also possible to see the scale of the enhanced Turkey-Africa relations from trade figures. In 2000, Turkey's trade volume with sub-Saharan Africa was USD 742 million, which increased to USD 6 billion in 2007 and nearly USD 16 billion in 2011, before falling again to USD 8.4 billion in 2014. Turkey's share in total African (including North Africa) trade is 2.2% (Shinn, 2015). The Turkish government projected that it would increase the trade volume to \$50 billion by 2015, but this target has now been postponed to 2018 (AA, 2014). To realize this goal, various business organizations have organized mutual fairs and meetings with their African counterparts, building a "trade bridge"

between Turkey and the continent. When we scrutinize the data, we see that Turkish imports from Africa have risen faster than Turkish exports to the continent. This is partly due to the rise in the prices of oil and gold but also due to the increased volume of raw material and mineral imports, particularly from sub-Saharan Africa (Aybar, 2008a).

This also encompasses visits, technical assistance and aid, and the economic relations have progressed according to the Enhancing Economic Relations with Africa Strategy (AUEIGS) that was put in force in 2003. The Council of External Economic Relations (DEIK) organized the Turkish-African Business Forum in 2008, where the formation of a Turkish-African Chamber of Commerce was initiated. Since then, private sector interactions have increased tremendously, and as Turkish goods and capital enter the African market, the importance of the African presence in Turkish markets has become more clear (Aybar, 2009).

One of the fundamental reasons behind this increase is the recent high growth performance of the Turkish economy. Recently released data on the performance of the Turkish economy shows that Turkish GDP growth was 8.8% in the second half of 2011, allowing Turkey to claim second place in the hierarchy of world economic growth rankings after China (Aybar, 2012). After shrinking by 4.6% in 2009, the Turkish economy recovered by achieving an 8.9% growth rate in 2010 and 11% in 2011. In 2015, Turkey registered near 4% in economic growth. This remarkable economic performance is actually accompanied by a

process of deeper transformation of the economy, which can be best captured in view of Turkey's fledgling Outward Foreign Direct Investment (OFDI). It is now solidly established that Turkey has joined the ranks of capital exporting developing countries, alongside Brazil, Russia, India, China, etc. This follows the rise in Turkey's productive capacity, foreign trade performance and increased domestic demand (Sabah, 2015).

On the one hand, while Turkey can't ignore the African market for its own products, it must engage with the African continent for its raw materials, which are needed as inputs for the diversified Turkish industry. The stock of OFDI from Turkey into Africa reached a level of USD 16 billion in 2011, mostly in the construction sectors in Senegal, Sudan, Ethiopia and Eritrea. This figure is expected to rise to \$24 billion at the end of 2016.

In order to improve trade with the continent, Turkey has signed bilateral trade agreements with a number of countries, including the Ivory Coast, Mauritania, the Republic of South Africa and Madagascar (all in 2005). The African market has been targeted particularly by Turkish small and medium enterprises (SMEs). In this sense, given the structural nature of the Turkish and African economies, they seem to be complimentary. Africa appears to be a market for Turkish firms, while Turkey offers a large market for African primary goods. The Republic of South Africa, Nigeria, Algeria, and Morocco are at the top of the list for Turkish exports. These countries are also at the top of the list for Turkish

imports. In 2011, Turkey organized a popular campaign akin to Live Aid of the 1990s to raise help for Somalia. This campaign aimed to raise public awareness among the Turkish people of the famine in Somalia; as a result, following the Western pattern, pop stars, NGOs and government offices mobilized around this campaign.

In a nutshell, Turkey-Africa relations are following a positive trend, which also serves as an important input for the new Turkish multilateral foreign policy. Overall, such interactions with the African continent are also expected to help Turkey in its efforts to join the European Union as a full member. On the other hand, while Turkey is carefully crafting its Opening to Africa Strategy into a win-win equation, it is fearful of being seen as a colonial country entering Africa. In this sense, it aims to share its experience with economic development with the African partners.

But what is the driving force behind such interaction? In other words, to what extent do these two entities pull/push each other and to what extent selected factors played a role in this process? Questions relating to the strength of the interaction between Africa and Turkey are important to establish guiding principles to develop future relations. Briefly, if there exists gravitational force between the two, what are the determinants of such force and which factors appears to be the most significant ones? What are the determinant factors that has the strongest gravitational impact between Turkey and selected African countries. These questions require a more rigorous investigation of recent

interactions between Africa and Turkey by using a technical methodology. In this paper, we use the gravity model to measure the gravitational force between Africa and Turkey. The next section presents the gravity model and how it is operationalised in this paper.

### **THE GRAVITY MODEL AND DATA SPECIFICATION**

The gravity model was first formulated by Tinbergen (1962), where the author argues that trade among countries is determined by the size of their incomes (which Tinbergen measures in gross national product, or GNP) and the geographic distance between them. Linneman (1966) added the population variable to the model, which had been successful in explaining trade flows but initially lacked theoretical background. After a wave of criticism against the gravity model in the 1970s and 1980s, several authors – including Anderson (1979), Bergstrand (1985, 1989, and 1990), Deardorff (1998) and Helpman and Krugman (1985) – proved that the model had a strong theoretical background.

The gravity model is explained as a common formulation of the spatial interaction method. It is named after a similar formulation used by Newton's formulation of gravity. Accordingly, the pull between the two objects is proportional to their mass and inversely proportional to their respective distance. Consequently, the general formulation of spatial interactions can be adapted to reflect this basic assumption to form the elementary formulation of the gravity model:

$$T_{ij} = \frac{Y_i^\alpha Y_j^\beta}{D_{ij}^\theta} \quad (1)$$

where  $T_{ij}$  is trade between country  $i$  and  $j$ ,  $Y_i$  is country  $i$ 's gross domestic product (GDP),  $Y_j$  is country  $j$ 's GDP and  $D_{ij}$  is the physical distance between the two countries. Thus, spatial interactions between locations  $i$  and  $j$  are proportional to their respective importance divided by their distance. The parameters  $\alpha$ ,  $\beta$  and  $\theta$  are generally estimated in the log-linear version of the model as follows:

$$\ln T_{ij} = \alpha \ln Y_i + \beta \ln Y_j - \theta \ln D_{ij} \quad (2)$$

As noted by both equations (1) and (2) above, the gravity model suggests that trade flows between the two countries are positively related to their economic size and negatively related to the physical distance between them, which refers to the transportation costs. Since Tinbergen (1962), the model has been developed and extended in a variety of forms, adding other variables that might affect trade flows such as prices (see: Bergstrand 1985 and 1989; Anderson, 1979). Other variables referring to trade costs – other than distance that indicates transportation costs – were added to the model, such as dummies on borders, cultural or historical (colonial) links among countries, language similarities, and membership in free trade area and/or other trade-related agreements.

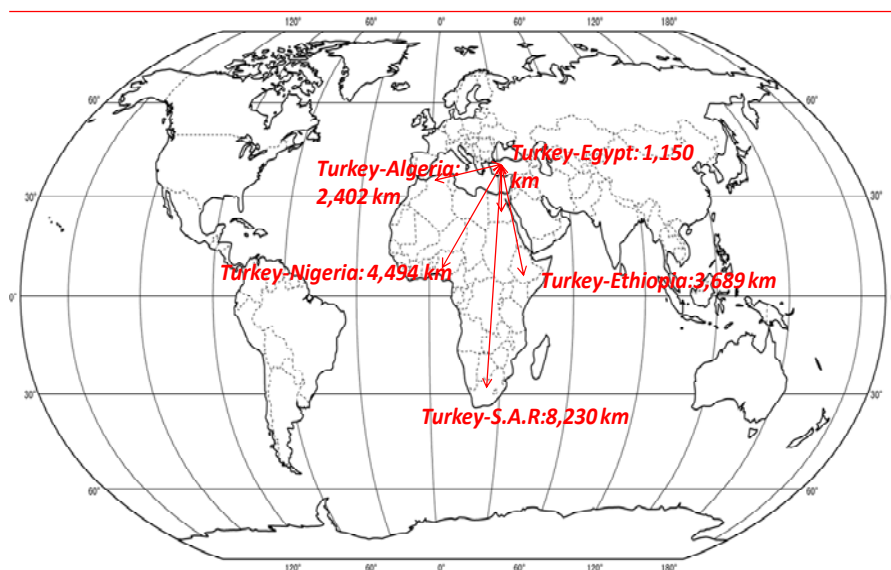
There have been a number of studies aiming to analyze the determinants of Turkey's trade flows through gravity models. These studies analyze different aspects of trade, for instance, the role of the EU in Turkey's trade flows, the effects of Chinese exports on Turkish exports or the determinants of Turkish agricultural exports to the EU. However, there exists no reference in the broader literature of analysis that measures Turkey-Africa trade relations by using a specified gravity model. This paper fills this gap.

### **Data specification**

It is necessary to reiterate at this point a note of caution on the reliability and availability of data as already mentioned in the abstract of this article. This renders fieldwork based research more valuable, though it requires rather large financial resources. The present paper is not based on a fieldwork research but instead relies largely on available data. Hence, the findings presented here ought to be viewed as indicative rather than well grounded scientific facts. African data is difficult to find, and when found, it is with "time" gaps. In this study, with this in mind, we have collected data from a variety of sources for 52 countries covering the period of 2000 to 2009. Turkish trade data is gathered from the Turkish Statistical Institute (TUIK) and the Undersecretary of the Prime Ministry for Foreign Trade (Dış Ticaret Müsteşarlığı). Relevant data for Africa was gathered from the IMF's World Economic Outlook Database (2010). More specifically, this covers the data for population, GDP, per capita GDP, inflation rates, etc. We used the World Development Indicators Database of the World Bank for data on

unemployment. Google Earth was used to measure direct distances between Turkey and its trading African partners, typically between capital cities of each country, as is presented in the below graph 1. Collected data was then put into panel form. After having completed the data collection, we used e-views software to carry out our regressions.

**Graph 1.** *Distances from Ankara, Turkey to the capital cities of the selected sub-Saharan countries*





## EMPIRICAL TESTING AND FINDINGS

In the present study, we have extended the model by including variables to account for, tariffs (ACP), access to the sea (LL), history (HIST), and other variables of interest.

We estimated the following log linear regression:

$$\ln(X_{ta}) = \beta_0 + \beta_1 \ln(GDP_{ta}) + \beta_2 \ln(M_{ta}) - \beta_3 \ln(DIS_{ta}) + \beta_4 \ln(INF_{ta}) + \beta_5 \ln(PER_{ta}) + \beta_6 \ln(POP_{ta}) + (HIST)_{ta} + (ACP)_{ta} + (LL)_{ta} + (BTA)_{ta} + \varepsilon_{ta}$$

- *HISTdum1*: historical affiliation
- *ACPdum2*: member of African, Caribbean and Pacific Integration
- *LLdum3*: landlock
- *BTAdum4*: bilateral trade agreement
- $\varepsilon_{ta}$ : is the error term

Findings in this study indicate that a rise in Turkey-Africa trade relations is heavily determined by bilateral trade agreements and historical ties.

It can be traced from below Annex 4 and 5, that Distance between trading partners has expected sign as it has a negative impact on trade. It is also important to note that while GDP plays a significant role in gravitational force, the size of the population has a negative impact.

When we consider exports from Turkey to Africa, historical ties appears to be significant but not as much as bilateral agreements. Bilateral agreements for Turkey’s imports has a negative sign. It is also important to note that contrary to the case with exports, Turkey’s imports are more significantly influenced with the size of exporting country population. This actually reflects the nature of trade between Turkey and the selected African countries. Turkish imports are more heavily dominated by extractive industries and labour intensive manufactures while exports are made up of intermediate and consumer manufactures.

It is also noteworthy to mention that for Turkish imports, presence in export markets are significant. Exports and imports appears to go hand in hand.

Although distance appears to have played a negative role in trade relations between Turkey and Africa, bilateral trade agreements appear to overcome such gravitational problems, as is the case with Nigeria and the Republic of South Africa. Also, despite the negative impact of distance over Turkey-Africa trade relations, where complementarities over production exists, this gravitational problem seems to be less important, as is the case with Sudan. Turkish trade with Africa is not significantly influenced by price movements but can suffer from competition from other developing countries.

Trade creation appears to be an important aspect of Turkey-Africa relations. In order to increase the volume of trade, a strategy of secular reduction of mutual tariffs must be carried out on the basis of price elasticities of demand. However, at this stage of mutual relations, trade creation is not going to be sufficient to reach the desired level of interactions. Trade with the continent is in favor of Africa. In this case, Turkey should increase its FDI in the continent. This will necessitate active participation in the international institutions based in Africa. Collaboration with regard to the use of technology and scientific research should be promoted through academic exchange programs.

## **CONCLUSION**

Recent Turkish interest in the African continent has multi-dimensional causes. It is partly related to the economic performance of some African countries and partly to Turkey's ambitions to rise higher in the world's hierarchy of states.

According to our gravity model, although historical ties prove to be important for improving win-win scenarios, bilateral agreements appear to be statistically more significant. In the presence of widespread poverty in sub-Saharan Africa, this makes foreign aid an important vehicle for developing bilateral relations. Under existing conditions, whereby agency capacity and distribution links are lacking, aid goes from government to government.

This revelation of the importance of the flow of aid for developing bilateral relations necessitates greater and more detailed study on the conditions and effectiveness of aid. One of the immediate policy conclusions to achieve aid effectiveness would be to develop a database of Turkish aid to Africa on par with international standards. An improved database is also necessary to study complementarities between the Turkish and African productive sectors. Turkish trade and direct investments with the continent are mostly carried out by SMEs. These firms lack capacity and rigor in calculating risk and expected returns. Hence, governmental guidance to determine incentive schemes and target sectors is important for SMEs. These calculations can only be done with a reliable dataset that only becomes available through the adoption and promotion of international accounting standards.

During the Turkey-Africa summit of 2008, it was agreed that Turkey should seek to develop relations with the African continent in a variety of areas, such as trade, direct investments, agricultural development, water management, infrastructure, telecommunications, transport, environmental protection, health, peace and security. It was also decided that the Turkey-Africa summit will take place every five years, and the second summit took place in 2014 in Equatorial Guinea. Sectoral complementarities and aid were the main focus of that summit.

Our investigation in this paper also has shown that it would be erroneous to tie Turkey’s Africa odyssey merely to the economic

milieu. The humanitarian dimension appears to be important, particularly in the areas of education, food security and healthcare. It is safe to conclude that the build-up of Turkey's presence in sub-Saharan Africa has developed around humanitarian discourse surrounding these said areas.

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## ANNEX

### 4. FINDINGS

DEPENDENT VARIABLE: X,  
 OBSERVATIONS 510

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.05E+08	27656101	3.789850	0.0002
DIS	-19736.42	5014.063	-3.936212	0.0001
DUM1	1.88E+08	32188417	5.840630	0.0000
DUM4	3.14E+08	42845943	7.339323	0.0000
GDP	0.002435	0.000256	9.522638	0.0000
M	0.182114	0.025936	7.021722	0.0000
POP	-0.880959	0.330680	-2.664083	0.0080
R-squared	0.720282	Mean dependent var		84570568
Adjusted R-squared	0.716946	S.D. dependent var		2.51E+08
S.E. of regression	1.34E+08	Akaike info criterion		40.27170
Sum squared resid	8.97E+18	Schwarz criterion		40.32982
Log likelihood	-10262.28	F-statistic		215.8734
Durbin-Watson stat	0.578005	Prob(F-statistic)		0.000000

## 5.

DEPENDENT VARIABLE: M

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	58939043	90939866	0.625118	0.5315
DIS	-5034.487	8644.632	-0.582383	0.5606
DUM1	3.21E+08	92420717	3.475011	0.0006
DUM2	-39282832	72267965	-0.543572	0.5870
DUM3	15874009	22933846	0.692165	0.4892
DUM4	-5.38E+08	70517030	-7.636110	0.0000
GDP	0.004174	0.000436	9.583688	0.0000
INF	83993.54	356192.9	0.235809	0.8137
PER	2091.306	4578.963	0.448957	0.6551
POP	-2.271959	0.574163	-3.956990	0.0001
X	0.485233	0.070296	6.902483	0.0000
R-squared	0.633319	Mean dependent var	1.02E+08	
Adjusted R-squared	0.625971	S.D. dependent var	3.89E+08	
S.E. of regression	2.20E+08	Akaike info criterion	41.27589	
Sum squared resid	2.41E+19	Schwarz criterion	41.38722	
Log likelihood	-10514.35	F-statistic	86.18658	
Durbin-Watson stat	0.694115	Prob(F-statistic)	0.000000	