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*Full Length Research Paper*

## The political economy of climate change

Guillermo Torres Carral

Universidad Autónoma Chapingo, México.

Received 9 November, 2014; Accepted 23 June, 2015

**This article debates institutional proposals given to address climate change which is not attacking basic socioeconomic determinants but only impacts such as emissions of greenhouse gases (GHE). Getting to the bottom of the problem requires moving beyond mere energy transition to renewable energy, which is necessary. But they are insufficient to ensure the preservation of life on earth and the social order. These circumstances enable the emergence of the political economy of climate change, introducing a necessary reform towards sustainability by applying the required and appropriate economic and financial instruments and regulations; thus it is not just a matter of adaptation and mitigation of this situation, but of restructuring the economy, society and culture to the benefit of people.**

**Key words:** Climate change, mitigation, adaptation, restructuring.

### INTRODUCTION: THE GLOBAL DISASTER

The solution around renewable energy could mean a great fallacy (Lovelock, 2007; Rifkin, 1993) while not taking into account the economic determinants of climate change. It means, with the current model in place oriented to profit as an end in itself; and reduced to combat its atmospheric impacts, all of which shows dramatic way we have changed the natural conditions on our planet; so this disrupts both the economy and society.

All this increases the fragility and vulnerability of the world and affects "sensitivity" (Roe, et al., 2007; Knutti and Hegere, 2008; Berger, 1980) of the state of the atmosphere, increasing its uncertainty (IPCC, 2007) even more in the social sphere.

The starting point is the analytical point of view from the economical economy (Costanza, et al., 1999), based on the principle of dependence of human societies from the natural environment; therefore, continue to insist on the absolute subordination of nature by man, it is to feed a greater ecological and social disaster.

It notes that, in the case of climate, such dependence has become almost absolute in the current phase of global warming, since it is no longer an independent factor (Acot, 2005), as it was previously and for centuries. Thus, unwittingly, we have returned to primitive society, with their vulnerabilities; which represents a contrast compared to rapid technological change.

E-mail: [gatocarr@hotmail.com](mailto:gatocarr@hotmail.com).

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## Climate crisis

We can start this discussion by highlighting the following paradox: although the origin and consequences of climate change affect the conditions of survival of the planet and therefore human societies, these changes are largely irreversible (Houghton, et al. 2001); however, human foundations themselves are reversible. In addition, this means the cost of opportunity to act more directly and effectively to this end.

It can be added that proposals on this issue, [corroborated in the Cancun Summit COP20 (2010); continued in Durban (2011) and Doha (2012)], only take into account technological and financial factors of the energy transition, in benefit in the practice of large private corporations, but not the majority of the population (which suffers overcrowding (Masahisa et al., 2000)).

The solution to this problem might not be the mere reduction of GHE by itself, because other factors are also present, and that extreme inequality increases in the economic model in place also contributing to the rise in temperature to concentrate the decisions about the management of the natural and social energy takes, and this affects the world.

Nevertheless, there is also the presence of factors such as deforestation, loss of biodiversity, reduction of glaciers, ozone, etc., all of which contribute to increased temperature, directly or indirectly, and all of them are important for themselves.

It should be noted that to reduce or to avoid greenhouse gas emissions, and the energy transition towards the widespread use of renewable fuels is not a warranty to be successful, and this has been shown throughout history (Clive, 2007; Gugha and Gadgil 1993) because the mismanagement of natural resources has always led to different environmental crisis.

Above all we must consider what economic factors conducive to this situation today, is necessary to counteract them like the price system, deregulation, inappropriate technologies, hyper-urbanization, inefficient agriculture, etcetera.

## The current climate change

The contemporary global climate crisis (Vidal et al., 2011) has been explained as the result of atmospheric concentration of greenhouse gases (CMNUCC, 1998; Calderón, 2012) product turn a model of society wasteful of energy and materials (Edwards, 2010), which has been seen outside (not inside) of nature (Benyus, 2002; Hawken, 2010), and even the interests of the majority of the population.

This is due to the nowadays lower planetary ability to reflect sunlight (albedo effect) caused by industrial

development (Lovelock, 2007). As a product of generation of liquid, solid and gaseous wastes; all of which, permit the persistent increase in temperature (beyond what would constitute an independent natural phenomenon of man); that after a point, it affects the natural balance, which in turn enable the conservation or human-social balances. All this is the result of even economic model in place, lacking adequate regulations (combining market with them) to work out the problem.

## The economics of climate change policy

We can say that the political economy of climate change, tries, more than anything else, explain and correct the multiple causes (economic, political and social), and the effects generated by this warming; product model of capital accumulation on a global scale based on the extreme inequality and liberalization. Such corrections are more or less drastic and gradual, under all the relationships involved.

It should be noted that, ultimately, GHEs are just one indicator of climate change, so those are not sufficient as an explanation; since this (as well as part of the environmental crisis) should be fought not only in its physical effects but in economic and socio-cultural causes (which have a basis on the mindset of the time).

## PURPOSE AND METHODOLOGY

This article deals with the possible routes that society and governments facing the presence of climate change at the global level (as it is an expression of the environmental crisis) and this is a growing and irreversible phenomenon as well as multi-determined (waste, irresponsibility, deregulation, model appropriation of nature, ignorance, consumerism, productivism).

The complexity of climate change, its causes and consequences, both natural and human are considered; all of which are closely interlinked and ongoing solutions to this problem.

Some strategic lines are defined in order to advance beyond offering gradualist measures in force have given poor results; which are applied without undertaking the necessary and broader transformations that are required in the economic and socio-cultural structure of today's world.

## POLITICAL ECONOMY AND CLIMATE CHANGE

The first consideration for analyzing this relationship, is that only a deep position on the climate change may also establish its limits, and propose a fair distribution of costs

and benefits derived from this phenomenon (Rawls, 2003; Hayward; 2005), moving towards an eco-social reorganization.

A key issue is that, besides being the main generator of GHE war economy (Melman, 1979) and the hyper-consumption (Georgescu-Roegen, 1975) they are factors that are constantly pushing the political society, creating uncertainty, worrying the public opinion and eroding the historical-natural bases of any possible and necessary development.

It is therefore indispensable to consider other variables to reverse climate change (e.g. the proportion in generating less waste compared to total capital, the rate of recycling, the reduction of the times of degradation, etc.), with their respective indicators that should take into account the economic, social and planetary health.

All this has to do with the need for an approach to natural ecosystems as a whole (together with economy), so refer to a carbon economy, it would be confusing if not takes into account simultaneously the total economy, understood as the unity between ecology and society, where carbon footprint is reduced to being a residue of economic activity.

The political economy of climate change then arises as a criticism of institutional policies to combat the climate change (Stern, 2008; Galindo, 2009), as it aims to go further than the deal with the effects of it, since it involves removing their fundamentals (Mc. Kibben, 2009), that they are in the mode of appropriation of nature as well as asymmetrical current socio-political relations.

Thus, two options are presented in the carbon economy: 1. Through the eco-social restructuring (Laszlo, 2008); and 2. or without it (Laszlo, 2008). The low-carbon economy (and the restructuring involved) means that it can be to the benefit or detriment of the majority of the population; so of course is not impartial.

### Public policies to climate change

The adaptation and mitigation policies raised in international agreements are limited to reducing GHE causing climate change, since not much consideration that some of the economic and social causes which explain at last such emissions.

The agreements reached at various summits are somewhat illusory way, since there are no real commitments; and all be solved voluntarily (without penalties), through economic mechanisms that turn out to be too weak to make progress in solving the problem. Therefore, the serious institutional diagnosis does not correspond to the agreed measures.

In the case of the Green Fund, it is a good idea but it cannot be realized at all, because the mechanisms for its implementation, as a matter of relegating no bilateral but

multilateral character is not defined. However, most difficulty it is that there is not enough availability of money, leaving only the agreement as a promise (to be fulfilled in 2020).

In the scheme proposed about transfer of technology, it is limited to opening markets to global companies, forgetting that technology must be designed according to local needs (Abetti, 1983), which requires generation of it adapted to the environment (even with foreign support), and not a mere transfer; besides, the need to open the global patent's system.

For its part, the REDD + program<sup>1</sup> aims to conserve forests and compensate the owners for it. This deepens the bond market carbon and environmental services; but masking and new forms of pollution control. The agreement also has been criticized for attempting to advance the privatization of "natural capital" (Sarukhán et al., 2009), depriving communities of their natural resources; for example, when the economic resources derived from the carbon market for the protection of the forest does not really runs to the forest.

The summits held, to accept further increases the temperature of the planet, did everything to maintain the status quo through the carbon market (and CDM)<sup>2</sup> from the Kyoto Protocol (CMNUCC, 1998).

### ATTACKING THE CAUSES OF CLIMATE CHANGE IMPLY RESTRUCTURATION

The climate has irreversibly changed in recent decades, at the same time its determinants have deepened. Therefore, the best way to counter it is not limited to adaptation policies and mitigation, present in the official discourse, because although they are indispensable, have failed to curb emissions so as expected in most cases. For this reason is therefore necessary to revise these [proposed in the CMCNUCC (1998)] and elaborate alternative concepts in the fight against climate change:

1. *MITIGATION*. Attacking the roots of the climate crisis is not a question of more or less greenhouse gas emissions, although of course it is necessary to reduce them. It is more than that, a real shock (Klein, 2008), although undertaken by civil society, not from above; moreover, of course to stop predation. It is a prerequisite for embarking on the path towards an alternative model with low carbon (and ecological) footprint, but with greater capacity, and by environmental democracy condition; where every person has what is necessary and sufficient to living.

2. *ADAPTATION*. This point is dealing to addressing the

<sup>1</sup> Reduction of Deforestation and Degradation Plus Program.

<sup>2</sup> Clean Development Mechanism.



vulnerabilities. It is a long-term strategy to be effective and should be based in evolution as a priority; therefore, as understood in the background compatibility human economy regarding nature. Thus, it must be exercised preventive planning of cities; and made respecting the natural and cultural conditions, applying the rules necessary to achieve land management and, therefore, population. The solution required is not only adaptation to climate change like a consequence of the devastation of nature; rather, society must adapt to nature, stopping the destruction and initiating a new way of relating to it.

3. **RESTRUCTURING.** Despite the climate crisis, it involves removing the socio-economic, cultural and technological processes that lead to present disaster, which *tout court* focus on ways to make profit at all costs, destroying the Earth and Man. It is necessary therefore to guarantee and ensure social control and surveillance of mega corporations.

It includes several strategic lines in this direction (especially for developing countries):

1. A fair and proper relationship between population and the territory, which is a real national decentralization, and that results in reducing the ecological and carbon footprint; 2. Reconstruction of large cities (C40, 2013), through a network of green small and medium cities with low carbon footprint; 3. Decentralization of budget resources in agriculture to promote small and medium-sized units as well as employment and food sovereignty; 4. Promotion of science and technology view from the eco-social conditions of each country; and 5. Substitution based on starvation wages and technological backwardness model, through a national agreement for the improvement of wages and productivity and strengthening the domestic market.

4. **PLANETARY COOLING.** It involves the application of longer-term measures. Especially how to properly manage the hydrological cycle, counteract acidification of the seas, increasing carbon sequestration; also, the extent and intensity of biomass production. Increasing the capacity of renewable natural resources and reducing the use of nonrenewable (Edwards, 2010); lessening the aggressiveness of cities and megacities (more green, less gray); driving the new agriculture aimed at reducing the use of petroleum and other fossil fuels, applying agro-ecological alternatives. Nevertheless cooling the planet means, at certain point of view, cooling the economic-political system (Latouche, 2008).

Therefore, the solution is more than energy transition, but take steps toward a deep restructuring of the economy, society and culture (among other changes). Since there we must also bear in mind that clean energy that is promoting, generate waste and does not eliminate the

second law of thermodynamic; and many times is not socially appropriate (hydro, wind, nuclear, biofuels). The climate crisis should enable more rapid environmental transition, because, otherwise, would continue embroidering only on secondary effects (atmospheric emissions); regardless of the foundations of today's world: the exploitation of Earth and Human being.

This whole thing means to reach a compatible development between society, economy and nature.

### THE LESSONS OF CLIMATE CHANGE

Finally, some lessons resulting from global climate change are as follows:

1. The greenhouse world (Rifkin, 1993) is rooted largely in dependence on the use of fossil fuels (which are still the cheapest), because of a model of society based on in obtaining an enormous private profits and governments to achieve an intended, but unattainable, sustained economic growth. However, the ultimate explanation of global warming is that all decisions made by the few and the few beneficiaries living of many, increasingly impoverished (Acot, 2005).

So then, would be that part of the emissions of developing countries they should be counted as part of global companies (plus it is made by country). Thus, the laxity of the laws would be offset on the periphery.

2. International Agreements reached in this area, as commitments were only rhetoric and surely must of governments are not able to fulfill the considered goals.

3. This phenomenon is both a real opportunity to take action, focused on overcoming the predatory mode of appropriation of nature and economic-political model dominant.

4. To undertake the troubles mentioned and the reforms that are necessary, we must recognize the unsustainability of the current relationship with nature (among humans) has come to corroborate that, beyond a point, the losses outweigh the desired gains.

5. Final Paradox: In spite of the cost of the adjustment (Piketty, 2014) mentioned derivative of climate change is the opportunity to move towards a new model of (sustainable) society (Edwards, 2010).

### Conclusion

Current global policies do not address the economic model which is not sustainable because of the planetary and human predation (which that privileges profit over eco- social repair damage) as well as the corresponding mentality; that corresponds; where economic security is above human and planetary security.

The human causes of world-gases emissions are correctable (although they have irreversible effects) and go through the disintegration of the predator model, as well as the faster energy transition; thus, minimizing the social cost of the inevitable adjustment, but under areal democratic way (that means democratic sustainability). Then, it would be useless then to the energy jump, if society continues to play an unnatural, anti-human and anti-democratic, still running mode.

Deeper changes are justified further by the fact that natural causes (independent of man) in global warming are also present, which means that the required changes are even more dramatic and persistent because if only a human issue could be more easily resolved, but not when it has disturbed the natural state of the Earth.

We must also note that the environmental crisis is not the result only of the application of inappropriate technology, entropy, the development model, mentality, etc.; but also, it is the result of human isolation.

Thus, only a fruitful universal dialogue by reaching clear agreements (Dyson, 1985) can lead to understanding the causes and give effective solutions to this human and planetary problem: equitably distributing the costs and economic, ecological and social benefits through global cooperation. This means that tackling climate change cannot be reduced only in terms to mitigate and adapt to it (which is as much as resigned to it, without considering the eco-social consequences).

Consequently, only a real economic and social restructuring (and certainly culture) may contribute to this local global problem solved, which is the most serious problem in the world in the present century (CMNUCC, 1998).

However, institutional solutions offered address this problem are presented in the context of (and political) economic monopoly, where the technology is not designed to apply to local conditions and according to the needs of the population, this entails huge private profits, albeit at the cost of huge negative externalities that society has to pay. This is unfair but it does not solve the problem worsens

Finally, after everything discussed above, it can be concluded that:

1. They are meager results of the fight against climate change to avoid the necessary restructuring of the economy and society.
2. Social inequalities are back: rich and poor growing even pollute differently.
3. Hence, it is necessary to subsidize new technologies, apply green taxes and ensure appropriate planning of the civil society.
4. It is therefore urgent to move towards the democratization of society (with a strong social sector).
5. The improvement of social welfare is essential for

achieve required transit (which requires higher pay for access to new technologies).

6. It is imperative to build a new world and environmental culture.

7. As break with the free market dogma, because it is full of faults (irrationalities); it is rather its combination with social and state intervention.

8. International agreements because of universal dialogue are key to overcome this problem.

9. The collapse is almost inevitable and must be confronted and overcome it through social re-appropriation, which requires urban resilience (Holling, 1973; Bianchini, 2010; ICLEI, 2013) and rural (PECC, 2009: 7; Buttel et al., 1987); and involves the global / local development and citizen empowerment; both in the countryside and in the city.

10. With these changes would move more and lower than the mere energy conversion cost, since it is better to spend to avoid emissions to combat them once they are there.

Finally, human survival should be creative and go beyond just thinking about repeating what has already failed with inadequate social benefits (Mc Donough and Braungart, 2002). This requires both known and novel financial instruments, to actually access to a new era post fossilize and make effective the fight against climate change; but this needs tackling the economic and political inequalities (Piketty, 2014)) and the enormous concentration of power behind them.

## Conflict of Interests

The author has not declared any conflict of interests.

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*Full Length Research Paper*

## The export-diversifying effect of foreign direct investment in the CEMAC Region

Dobdinga Cletus Fonchamnyo

Univeristy of Buea, Cameroon.

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This study aimed at investigating the export-diversifying effect of Foreign Direct Investment on the economies of the CEMAC sub region – notably, Cameroon, Central Africa Republic, Chad, Congo, Equatorial Guinea and Gabon. This was achieved empirically by using a Generalized Linear Model estimation technique implemented using the logit link function and the Gaussian distribution family to take care of the fractional nature of the concentration index. The results, both descriptive and empirical, showed that within the sub region the countries are heterogeneous in terms of foreign direct investment and diversification index. The most diversified economy in the region is Cameroon, followed by Central Africa Republic, Gabon, Congo, Equatorial Guinea, while Chad is the most concentrated with an index of 0.80. Empirically, the results clearly showed that in this region foreign direct investment, value added in the manufacturing sector and trade openness foster export diversification while rents from natural resource endowment and appreciation of the official exchange rate deter export diversification. The results also point to the fact that the export diversifying effect of foreign direct investment differs across economies in this region, with statistically significant effect obtained for Cameroon and Central Africa Republic, while an insignificant positive effect is observed for Congo. The results obtained are quite implicative, suggesting that policies should be put together to encourage foreign direct investment in countries such as Gabon, Chad and Cameroon that have witnessed very low levels of foreign direct investment in this region, while institutions and structures that are friendly for investors should be put in place to promote the manufacturing sector in the entire region.

**Key words:** FDI, export-diversification, CEMAC.

### INTRODUCTION

Exports have continued to increase dramatically from low income countries in the past couple of years, as a result of the increasing role played by exports. In many countries, especially those in East Asia, economic growth

led by exports has successfully elevated millions from the poverty trap through employment creation. Yamagata (2006)'s study on Cambodia, concluded by confirming that the new export orientated garments industry has

E-mail: [dfonchamnyo@yahoo.com](mailto:dfonchamnyo@yahoo.com).

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substantially increased employment and reduce poverty. A similar story is told by Kabeer and Mahmud (2004) in their study in Bangladesh and supported by Razafimahefa (2005) while researching on the role of export-oriented manufacturing in reducing poverty in Madagascar. Many other studies (Dizaji and Badri, 2014; Sousa et al., 2012) have arrived at the same conclusion supporting the notion that export oriented manufacturing can increase employment. In addition, some studies (Hesse, 2008; Agosin, 2007; Lederman and Maloney, 2007) have shown that export expansion may also contribute indirectly to economic growth by providing the much needed foreign exchange to pay for strategic exports.

Recently, in the discussion of export – led growth strategies, focused have been shifted to the growing role of the composition and diversification of the export bases of developing economies. The changing composition and diversification of exports may have important implication on employment, poverty reduction and overall economic development, especially as a majority of low income countries are now involved in divergence, while others are still in the course. This certainly means that there is great disproportion in experiences involving diversification. In addition to the focus by low income countries, many international institutions among which include the World Bank, the United Nations and the OECD, have also joined their voices to outline the potential benefits of export diversification. Furthermore, a number of studies including Lederman and Maloney (2007), Herzer and Nowak-Lehmann (2006) and Ghosh and Ostry (1994) have also noted a number of benefits accruing to economies with diversified export bases. These benefits among others include a lower terms of trade volatility and increased macroeconomic stability. In other studies outlining additional benefits of diversification, Agosin (2007) and Hesse (2008) concluded that economies which diversified their export bases also witnessed higher income growth rates, while Lederman and Maloney (2007) showed that export concentration correlates negatively with economic growth. Export diversification has also been found to contribute to export growth especially in low income nations, for instance, Brenton and Newfarmer (2007) found that export diversification accounted for 57% of the total export growth in their study of some African nations.

From the forgoing discussion, it is therefore not surprising if several countries especially those of developing and emerging countries are striving to broaden their export bases. The interesting issue in this new perspective is that Foreign Direct Investment (FDI) which may not only contribute directly to economic benefits, but which can have great implications on export diversification or broadening has been overlooked. In the past decades, many low income countries have experienced large inflow in FDI and are putting in place competitive social and political conditions to continuously

pull FDI. According to Newfarmer et al. (2009), the strategies adopted by some countries, notably Kenya, Botswana, Cambodia for diversification and promotion of exports directly cite the key role that FDI can play in boosting and developing new industries engaged in exportation. In Kenya for instance, the reform on export broadening focuses on a diversion from primary production to the improvement in the quantity and quality of manufactured goods (International Trade Centre, 2001). Vietnam has also transformed its economy from a low-end agricultural exporter to a successful middle-range manufacturing exporter in less than two decades, while Tanzania and Uganda have also undergone significant export diversification in the last 20 years.

In terms of indirect effect, Banga (2003) argues that FDI can foster the growth of the exportation base through the spillover effects on the level of export of the home grown firms who are involved in the traditional export sector. This spillover effect generated from the fact that the export of foreign firms in this sector lowers the fixed cost of introducing the sector's product in the foreign market. In addition to lowering the fixed cost, the home-firms may also learn and gain experience from the foreign firms and become knowledgeable about the existence of new markets and openings in the foreign markets. All these put together will promote the export diversification base of the home economy.

It is therefore evident from the above that FDI can potentially play a great role in influencing export diversification. Countries that have credit their diversification as being driven by FDI flows include Costa Rica, Mauritius and Chile. Costa Rica and Mauritius partly attribute their diversification in electronics industry on this. Some specific case studies of instances where FDI helped develop new export industries have been documented in many countries including India (Banga, 2003) and Bangladesh (Rhee, 1990). While large bodies of literature have examined the drivers of export diversification; the importance of export diversification and the benefits of FDI; only a few have explored the links between FDI and export diversification, especially empirically. Thus, it is imperative to investigate the effect of FDI on export diversification. This paper is therefore aimed at investigating the effect of FDI on export diversification on the economies in the CEMAC Region using a fractionalized logit model estimation technique.

The rest of the paper is divided into four sections. The section on literature review makes a review of existing literature on export diversification with a focus on key factors influencing the growth of export diversification. In the section for empirical model specification and estimation, the empirical estimation methodology adopted in this study is explained, while the section for presentation and discussion of results presents the stylized facts existing between FDI and export diversification and also presents the results obtained from the empirical analyses. The last section draws conclusion

with focus on the policy implications of the results.

## LITERATURE REVIEW

The literature on export diversification is quite vast and focus on issues dealing with measurement of diversification (Cottet et al., 2012; Hausmann and Klinger, 2006; Rodrik, 2006), pattern of export diversification (Amurgo-Pacheco and Pierola, 2008; Hummels and Klenow, 2005), the effect of export diversification on growth (Klinger and Lederman, 2006; Hesse, 2008; Cadot Strauss-Kahn and Carrere, 2011) and the determinants of export diversification (Agosin et al., 2011; Changbiao, 2009; Jayaweera, 2009; Munemo, 2007). Other groups of studies have shown that export diversification can potentially help stabilize the export earnings of countries in the long run. Among these studies include those of Ghosh and Ostry (1994) and Bleaney and Greenaway (2001).

Recently, some studies (Hesse, 2008; Cadot et al., 2011) have shown that diversifying the exportation base can be directly related to improvement in per capita income. According to these studies, an increase in per capita income will result to an increase in export diversification, though this may only be up to a given level of income. For instance, in the study of Hesse (2008), a system Generalized Methods of Moment estimation technique was employed to investigate the effect of export concentration on economic growth in a sample of 99 countries. The study included a squared term for the Herfindahl-Hirschman Index of concentration to investigate the existence of non-linearity between growth and diversification. The results obtained showed some evidence of a non-linear relationship existing between concentration of export and per capita income growth, albeit the coefficient on the squared term was statistically insignificant. However, in an earlier study by Cadot, Strauss-Kahn and Carrere (2011), they found out that the relationship between per capital income and diversification was U-shaped supporting the view that countries tend to diversify their export bases as they grew from low income to middle income nations, but then concentrated their exports after reaching a high income level. The results obtained supported those obtained by Imbs and Wacziarg (2003) that also suggested the existence of a U-shaped between concentration and per capita income.

Al-Marhubi (2000) in a conventional cross sectional country growth regression using different measures of export diversification/concentration to link to the standard growth equation, found out that export diversification promotes economic growth. These findings were robust and consistent to the different models specified. In a similar cross-sectional study carried out by Agosin (2007), the results showed that the effect of export diversification on per capita income growth was stronger

only when a country's exports grew faster than the per capita income growth. Other studies, notably Herzer and Nowak-Lehmann (2006) and Lederman and Maloney (2007) also found evidence that supports the fact that export diversification has a positive influence on economic growth.

A new strand of literature considers the role played by the pattern of export diversification, that is, it investigates whether export growth is predominantly motivated by growth at the extensive or intensive margin. In terms of extensive margin growth, countries export a wider set of products to existing or new geographical markets whereas under intensive margin growth, an increase of existing products to current markets occurs. Hummels and Klenow (2005) in their study using data on shipments by 126 exporting countries to 59 importing countries in 5,000 product categories; showed that the extensive margin accounts for around 60 percent of the greater exports of larger economies. This result was supported by those of Pham and Martin (2007) using a cross-sectional analysis who found out that about 70 percent of the growth in exports in their sample of 120 exporters and 76 importers was explained by extensive margin growth. The results obtained by Hummels and Klenow (2005) and by Pham and Martin (2007) were in contrast with the results of the time series analyses employed by Brenton and Newfarmer (2007) and Amiti and Freund (2006). Both results showed low rates of extensive margin growth over time suggesting that exporting larger quantities of existing products matter more than exporting a wider set of products. The results also point to the fact that exporting existing products to new geographical markets carries a higher weight in explaining export growth than discovery of new products. The conflicting results on the role of the pattern of diversification may be as a result of the different methodology and set of countries used in the different analyses.

In terms of determinants, Munemo (2007) analyzed the effect of foreign aid on export diversification using panel data from 69 developing countries employing the instrumental variables (IV) estimation technique. The findings of the study indicated that foreign aid had a negative effect on export diversification. On his part, Changbiao (2009) used a panel data to examine the determinants of exports in Chinese electronics industry for the period 1999 to 2002. The study showed that FDI was a significant and positive determinant of export growth in China. Similarly, by considering FDI as one of the determinants of export diversification, Jayaweera (2009) built an econometric model of instrumental variables to estimate the relationship between FDI and export diversification for a panel of 29 low income nations for the period 1990-2006. The findings showed that FDI had a positive impact on export diversification.

Using a panel data-set for 60 countries from 1985-2004, Parteka and Tamberi (2011) assessed the role played by country specific factors in determining the

exports diversification process by applying different synthetic indices of specialization. Their findings revealed that countries located far from the economic core of the world and those for which barriers to trade are large tend to have less diversified manufacturing exports. In a similar study, Agosin et al. (2011) analyzed the determinants of export diversification around the world from 1962 to 2000, employing the Herfindahl et al. indices as measures of export diversification. Their data were analyzed using the Generalized Method of Moments (GMM) and the findings showed that human capital accumulation contributed positively to diversify exports while real exchange rate volatility encouraged export concentration.

### Empirical model specification and estimation

Within a panel data setting in which a cross sectional unit has relatively smaller time periods, the empirical model to be estimated in this study is generally stated as:

$$EXDIV_{it} = X_{it}\beta + \varepsilon_{it} \quad (1)$$

Where; EXDIV=Export Diversification index is measured using the World Bank's measure of the Herfindahl-Hirschman Concentration Index. The index is a measure of the degree of market concentration. It has been normalized to obtain values ranking from 0 to 1. An index value that is close to 1 indicates a very concentrated market (maximum concentration). On the contrary, values closer to 0 reflect a more equal distribution of market shares among exporters or importers. In other words, when the value of the Herfindahl-Hirschman Index approaches one, the country has a greater reliance on a limited group of exports, while a value closer to zero represents a higher degree of export diversification.

$$EXDIV_{it} = \beta_0 + \beta_1 LFDI_{it} + \beta_2 LOPEN_{it} + \beta_3 LRENT_{it} + \beta_4 LGDPPC_{it} + \beta_5 LOER_{it} + \beta_6 MVA_{it} + \varepsilon_{it} \quad (2)$$

In estimation of the above model, though the Ordinary Least Squares (OLS) estimator, the Instrumental Variable estimator, the panel data estimator or even the GMM of a linear model may yield consistent estimates even by ignoring the bounded nature of the dependent variable, they however, do not guarantee that their fitted values lie within the unit interval nor that their partial effect estimates for the regressors' extreme values are good (Nam, 2014). Thus, an additional innovation about this study hinges on the fact that the estimation technique used is the fractionalized logit model which counters the weakness of the former techniques of estimation by considering the fractional nature of the concentration index. We adopt the fractional logit model after Papke and Wooldridge (1996) which is a quasi-likelihood

method that does not assume any distribution but only requires the conditional mean to be correctly specified for consistent parameter estimates with an identical likelihood function similar to that of a Bernoulli distribution. This was implemented in Stata 12.0 through the Generalized Linear Model (GLM), using the logit link function and the Gaussian distribution family to take care of the fractional nature of the dependent variable (concentration index) which ranges between [0,1].

Thus, it can be considered as an indicator of the exporter's vulnerability to trade shocks and since it is measured over time, a fall in the index may be an indication of diversification in the exporter's trade profile.

This index is computed using the formula:

$$HHI = \frac{\sqrt{\sum_{i=1}^n \left(\frac{x_i}{X}\right)^2} - \sqrt{\frac{1}{n}}}{1 - \sqrt{\frac{1}{n}}}$$

Where:

HHI= Herfindahl-Hirschman Index (proxy for diversification)

$x_i$  = value of exports of product  $i$

$X = \sum_{i=1}^n x_i$  and  $n$  = number of products

The choice of this measure of diversification is contingent on the fact that it helps determine whether the majority of a country's export earnings comes from a small range of export products, (which is more an indication of export concentration) or the source of export earnings are more evenly spread across a given range of export goods (an indication of export diversification).

$\beta$  is a vector of regression coefficients to be estimated,  $X_{it}$  is a matrix of regressors which are; Foreign Direct Investment Net Inflow (LFDI), trade openness (LOPEN), rents from natural resource endowment (LRENT); Real Gross Domestic Product per capita (LGDPPC), official exchange rate (LOER) and manufacturing value added (LMVA). All these variables were logged and a detailed definition of the variables is described in Table A1 in the Appendix.

The linear structure of equation (1) is thus specified as;

### PRESENTATION AND DISCUSSION OF RESULTS

The data used in this study are panel data collected for a period of 19 years (1995 - 2013) for six countries

(Cameroon, Central Africa Republic (CAR), Chad, Gabon, Equatorial Guinea and Congo). Most of the data were obtained from the World Development Indicators databank (Table A1 on definition of the variables). The concentration index was obtained from the United Nations Conference on Trade and Development Statistics (UNCTADstat), which produces a comprehensive data of more than 150 indicators and statistical time series essential for the analysis of International trade, economic trends, foreign direct investment, external financial resources, population and labor force, commodities, information economy, creative economy and maritime transport. From the data obtained a summary statistics of the variables used in the estimation is presented in Table A2 in the Appendix by country. The summary table shows the mean of the variables used in the model, while the pairwise correlation results are found in Table A3.

From the table, the average on trade diversification is 0.65 for the CEMAC zone, while in terms of individual countries the statistics shows that the most diversified economies in the CEMAC zone are Cameroon (0.39), Central Africa Republic (0.45), Gabon (0.74), while the most concentrated are Chad (0.80), Equatorial Guinea (0.76) and Congo (0.75). In terms of FDI as a percentage to GDP, the average in the sub region is 7.9 percent, while Equatorial Guinea, Chad and Gabon received a lion share of the FDI in the region with 23.14, 12.81 and 7.38%, respectively. The average GDP per capita in the region stands at \$3202.64, with Equatorial Guinea, Gabon and Congo topping the list with \$9069.82, \$6627.09 and \$1714.96, respectively, while CAR has the least per capita income (\$365.29) followed by Chad (\$542.46) and Cameroon (\$896.23). Looking at trade interaction with the rest of the world measured using trade openness, the average for the region stands at 109.53, while the most open economies in the Sub Region are Equatorial Guinea (271.71), Congo (136.11) and Gabon (92.82), Chad (74.18), Cameroon (42.78) and CAR (39.59). Concerning total rents obtained from the stock of natural resource endowment, the summary statistics shows an average of 31.67 as a percentage to GDP for the region, while Congo tops the list with 63.14%, followed by Gabon (46.22%) and Equatorial Guinea (33.08%)

The summary fails to give a clue of the key relationship that may exist between FDI and the export diversification for the six countries in the CEMAC zone. A preliminary analysis using a pair wise correlation for the variables is presented in Table A3 in the Appendix, while a scatter plot to better understand the association between these two variables is presented in Figure A1 in the Appendix, for each country. The scattered plot for FDI as a percentage to GDP and the concentration index measured by the Herfindahl Index, for the various economies clearly shows that except for Congo, a negative relationship exists between the concentration index and FDI as a percentage to GDP. This result is

supported by the pairwise correlation matrix presented in Table A4 between FDI and the Herfindahl concentration index for the various economies. The implication from these results is very clear indicating that an increase in FDI as a percentage to GDP is associated with a decrease in the concentration index. In other words an increase FDI as a percentage to GDP promotes diversification in the export bundles. It is also evident from Figure A1 and Table A4, that this relationship is not the same for all the economies. This is supported by the empirical results presented in Table 1.

The standard errors of the results presented in Table 1 are robust to control for potential heteroscedasticity that may result from misspecification. The results presented in column one were implemented controlling for the panel nature of the data composed of six countries (clusters) over a period of 19 years, while the rest of the results were estimated for each country. Worth mentioning that Equatorial Guinea and Gabon had only 9 and 13 observations, respectively due to missing values for key variables included in the estimation, as observed in the table below.

The results presented in column one clearly showed that a majority of the variables used in the analysis, albeit for real GDP per capita are statistically significant. The results indicate that foreign direct investment, openness, real GDP per capita and value added in manufacturing have a negative effect on concentration, while the official exchange rate and rents from natural resource endowment were found to have a positive effect on export concentration. The negative relation between concentration and the respective variables implies that an increase in the value of these variables will result to de-specialization or diversification, while the positive relationship indicates a movement towards more specialization or concentration.

Specifically, the results show that on the one hand, an increase in foreign direct investment, trade openness and value added in manufacturing will increase the likelihood of a country to diversify. The effects of these variables are statistically significant at various levels as shown in Table 1. The results from column one for the entire CEMAC region show that an increase in Foreign Direct Investment (% GDP), trade openness, GDP per capita and value added in manufacturing by one percent will result to an increase in the likelihood to diversify the exportation bundle in the CEMAC region by 0.0843, 0.2712, 0.0805 and 0.4058 percent, respectively. On the other hand, a percent increase in the official exchange rate and the rent from natural resource endowment will increase the likelihood to concentrate (i.e. likelihood to diversify is reduced) by 0.6450 and 0.1151 percent, respectively, everything being equal.

Other results presented in column two to seven for the individual economies are in support of the results presented in column one for the entire sub region, especially when the signs of the coefficients are



**Table 1.** Empirical results of the effect of FDI on export diversification in the CEMAC region.

Variable	Coefficient (Robust standard errors)						
	All countries	Cameroon	CAR	Chad	Congo	Equatorial Guinea	Gabon
<b>LFDI</b>	-0.0843*** (0.0257)	-0.2763*** (0.0548)	-0.1165** (0.0448)	-0.0227 (0.0842)	0.0231 (0.1709)	-0.0502 (0.1071)	-0.0131 (0.0183)
<b>LOPEN</b>	-0.2712** (0.1079)	-0.0419 (0.2434)	-0.1350 (0.3546)	-0.1172 (0.1270)	-1.1343 (0.7149)	-0.1405* (0.0737)	-3.975* (2.2467)
<b>LRENT</b>	0.1151*** (0.0328)	0.6322*** (0.1955)	-0.1481 (0.3555)	-0.0752 (0.1182)	0.6788* (0.3565)	-0.0676* (0.0420)	-3.8984** (1.535)
<b>LGPPC</b>	-0.0805 (0.1729)	-1.2673** (0.5097)	-0.2239 (0.3271)	0.8118*** (0.2906)	0.0156 (0.2051)	0.8535*** (0.2631)	-0.0765 (0.6217)
<b>LOER</b>	0.6450** (.3254)	0.4663* (0.2507)	1.0404** (0.292)	0.6649** (0.2728)	-0.5245*** (0.188)	0.6386 (0.5867)	1.442*** (0.1714)
<b>LMAN</b>	-0.4058*** (0.0942)	-0.6278** (0.2830)	-0.7140* (0.3902)	-0.0325 (0.0366)	0.3642* (0.2141)	-1.542*** (0.3747)	-1.822 (1.699)
<b>Cons</b>	-2.1470 (1.9972)	6.312 (4.3493)	4.6082 (8.5046)	-7.387*** 2.457	-2.688 (6.327)	-11.237** (5.701)	-10.407 (14.688)
<b>No. of observations</b>	97	19	18	19	19	9	13

\*\*\*, \*\* and \* represent 1%, 5% and 10% level of significance

considered. Exceptions that are quite visible are observed with Chad and Equatorial Guinea where real GDP per capita has a positive and statistically significant effect on the concentration index, implying that an increase in per capita income in these two economies will result to an increase in the likelihood to concentrate (i.e. de-specialization). In terms of country specificity, the results obtained for Congo are quite different from those of the other countries in this region. For instance, the effect of FDI, GDP per capita income and value added in manufacturing are positive contrary to the results obtained for the entire region, Cameroon, CAR and Gabon. The positive effect observed for per capita income is however consistent with the results obtained for Equatorial Guinea and Chad.

The results obtained in this study put together showed that on average an increase in foreign direct investment as a percentage to GDP will encourage export diversification in the CEMAC region. In same light, trade openness, value added in manufacturing, increase in real GDP per capita also promotes export diversification in the region. The results also point to the fact that an increase in official exchange rate and the rents from natural resource endowment will result to export concentration. In this sub region, it is quite evident from the analysis that the effect of foreign direct investment differs across the countries in this region with the greatest influence observed in Cameroon with a FDI coefficient of 0.2763.

The results of this study are consistent with some

previous findings. Specifically, the negative effect of per capita income on export diversification in the CEMAC sub region is contrary to the results obtained by Kamuganga (2012) and Cabral and Veiga (2010) who found a positive and statistical significant effect of GDP per capita on export diversification. However, the result is consistent to those of Elhiraika and Mbate (2014) and Parteka and Tanberi (2011) who found a negative and statistically significant effect of per capita on export diversification. The effect of FDI is consistent with those of Bebczuk and Berrettoni (2006) though they found FDI to have a negative and statistical insignificant effect on export diversification, as opposed to this study which shows that on average FDI has a negative and statistical significant effect on export concentration thereby promoting diversification in this region.

The effect of the manufacturing sector is consistent with those of Bebczuk and Berrettoni (2006), though our result is statistically significant. The result on the effect of trade openness is contrary to the results obtained by many of the previous studies (Omgeba, 2013; Kamuganga, 2012 and Agosin et al., 2011) who all found that trade openness had a positive and significant effect on export concentration, meaning that openness discourages diversification as opposed to the results in this study which showed that trade openness promotes diversification. However, Alaya (2012) in their study of 12 Middle East and North Africa countries found results consistent with those in this study, which showed that trade

openness promotes export diversification. The result on the impact of rents from natural resources is consistent with Lederman and Maloney (2007)'s argument that there is a tendency to export concentration in resource-abundant countries. This result is however not consistent among the economies of the sub region. A negative and statistical significant effect was obtained for Equatorial Guinea and Gabon, while an insignificant effect was found for CAR and Chad. The result seems to point to the fact that natural resource based economies can still foster export diversification as witnessed by economies such as Uganda, Chile, Malaysia and Thailand (Newfarmer et al., 2009)

## CONCLUSION AND POLICY IMPLICATIONS

This study aimed at investigating the export-diversifying effect of FDI as a percentage of GDP on the economies of the CEMAC sub region – notably, Cameroon, Central Africa Republic, Chad, Congo, Equatorial Guinea and Gabon. Export diversification was measured using the Herfindahl-Hirschman Index which ranges between [0, 1] with 1 showing total concentration. The data were analyzed descriptively using pairwise correlation and scattered diagrams to examine the relationship existing between export diversification and FDI in the economies in this sub region. The empirical analyses were estimated using the fractionalized logit technique. The descriptive analyses revealed that there exists great disparity in the level of diversification and FDI. The average statistics showed that Cameroon is the most diversified with an average Herfindahl Index of 0.39, followed by Central Africa Republic (0.45), Gabon (0.74) Congo (0.75), Equatorial Guinea (0.76), while Chad is the most concentrated with an index of 0.8. In terms of FDI, Equatorial Guinea has the lion share in the region, followed by Congo and Chad.

The results of the empirical analysis revealed that overall diversification for the CEMAC sub region is significantly determined by foreign direct investment, trade openness, total rents from natural resource endowment, value added in manufacturing and Official Exchange Rate while GDP per capita was an insignificant determinant of export diversification. The results showed that an increase in FDI (% GDP) promotes diversification in the composition of the export baskets, that is, it encourages de-specialization thereby promoting a more heterogeneous export structure while an increase in natural resource based rents tend to promote specialization (that is a homogenous export structure), which fosters the exportation of goods belonging to a limited productive economic sectors or products. In the region, *ceteris paribus* an increase in FDI by 10 percent for instance will result to a reduction in export concentration by about 0.843% (that is, improvement in the likelihood to diversify), while an increase in rents from natural resource endowment by 10 percent may be associated with a

2.71% decrease in the likelihood to diversify, that is, increase in the likelihood to concentrate the export bundle. Other results showed that an increase in trade openness and an improvement in the contribution of the manufacturing sector are instrumental in fostering export diversification in the CEMAC region as a whole.

The results obtained for the individual economies were not homogenous. It was found for instance that the magnitude and statistical significance of the effect of FDI was greatest in Cameroon which is the most diversified country in the region, though receiving one of the lowest FDI as percentage to GDP. This is as opposed to Congo and Equatorial Guinea that received the greatest share of FDI (12.81% and 23.14%, respectively) in this region, but are very concentrated (0.75 and 0.76 for Congo and Equatorial Guinea). Other key differences in the results that probably need further investigation for a larger set of countries with abundant natural resources showed that export diversification can still be fostered for abundant rich natural resource economies. This effect was statistically significant for Equatorial Guinea and Gabon, which are economies receiving large share of rents (33.078 and 46.217%, respectively) from natural resources.

The above results therefore have key policy implications, suggesting that one effective way for economies in the CEMAC sub region to promote export diversification is to focus regulatory reform efforts aimed at facilitating foreign direct investment and promoting trade openness. The results also point to the need for the manufacturing sector to be encouraged. Although, the results in this study shows that on average the level of export diversification is significantly lower in natural resource-rich countries, there is some evidence that diversification can still be enhanced in natural resource based dependent economies. This could be done by implementing a broad collection of targeted strategies, such as the creation of a well-adapted export promotion arrangement, reducing cost associated with trade such as import and export duties. There is also need to foster investment and trade freedom in the exploitation and transformation of the natural resources. This will in tend increase the value added in manufacturing which will go a long way to enhance economic growth and trade diversification.

## Conflict of Interests

The authors have not declared any conflict of interests.

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## Appendices

**Table A1.** Definition of variables used in the estimation.

Variable	Description	Source
Concentration Index (EXDIV)	Herfindahl - Hirschmann index, is a measure of the degree of market concentration. An index value that is close to 1 indicates a very concentrated market (maximum concentration) while values closer to 0 reflect a more equal distribution of market shares among exporters or importers.	UNCTAD
Trade openness (LOPEN)	It is the Sum of imports and exports of goods and services as a ratio of GDP (measured in constant 2005 prices)	WDI
Foreign direct investment, net inflows as a percentage of GDP (LFDI)	Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor.	WDI
Natural resource rents (LRENT)	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	WDI
Official exchange rate (LOER)	It is calculated as an annual average based on monthly averages (local currency units relative to the U.S. dollar).	WDI
Manufacturing, value added (LMVA)	Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources.	WDI
Real GDP (LGDPPC)	Real GDP is gross domestic product measured in constant US dollars. (measured in constant 2005 prices)	WDI

**Table A2.** Summary statistics of variables used in the model.

Variable Country	Concentration Index	FDI	Openness	Rent	OER	VAM	GDPPC
Cameroon	0.39	1.56	42.78	11.004	551.20	18.28	896.23
CAR	0.45	1.53	39.59	10.944	551.20	6.67	365.29
Chad	0.80	7.38	74.18	25.613	551.20	5.65	542.46
Congo	0.75	12.81	136.11	63.136	551.20	4.85	1714.96
Equatorial Guinea	0.76	23.14	271.71	33.078	551.20	7.142	9069.82
Gabon	0.74	0.96	92.8196	46.217	551.20	4.46	6627.09

**Table A3.** Pairwise correlation results.

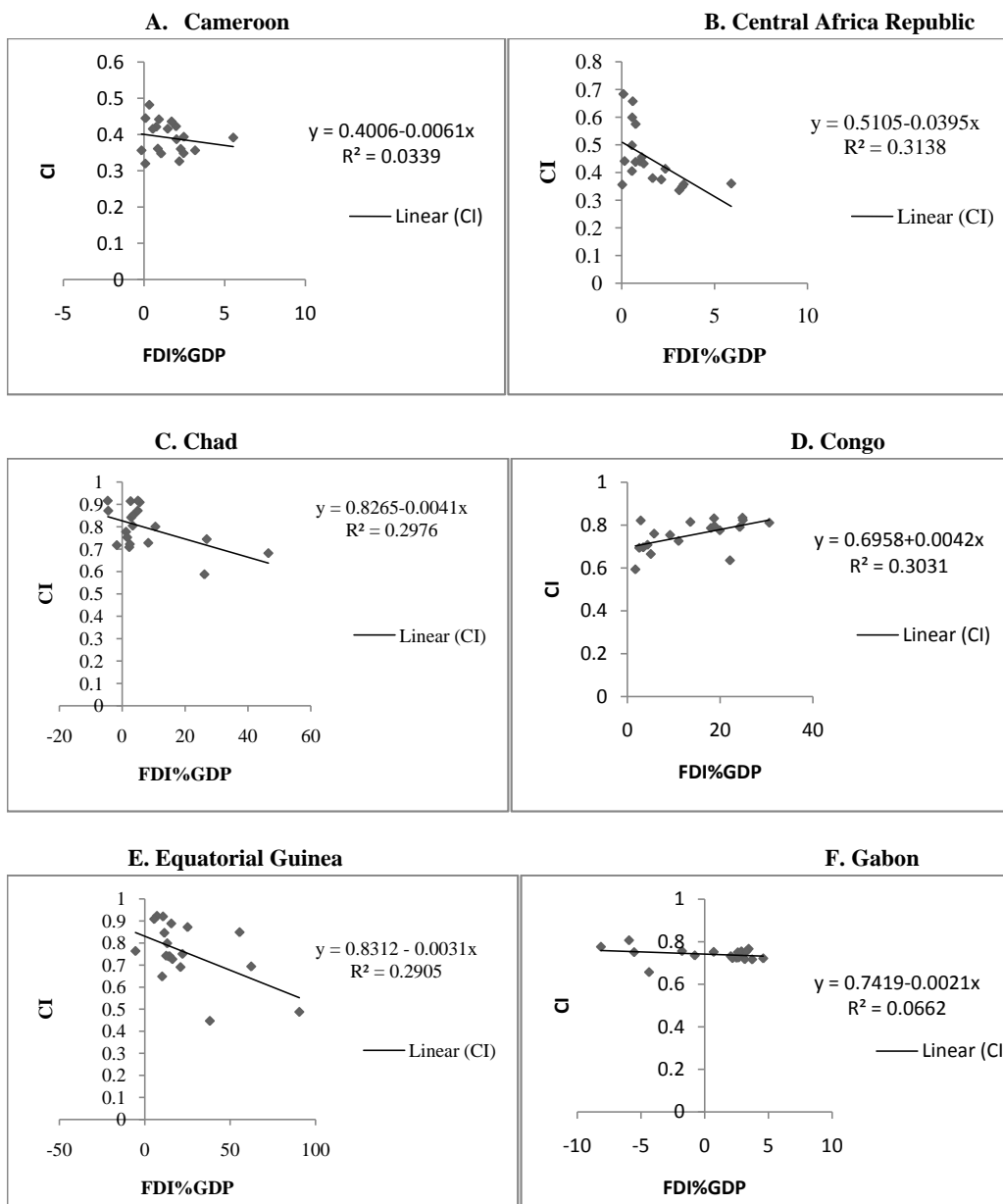
	LCONC	LFDI	LOPEN	LRENT	LOER	LGDPPC	LVAM
LCONC	1						
LFDI	-0.327***	1					
LOPEN	-0.2217**	0.1025	1				
LRENT	0.2325**	-0.0870	0.2031	1			
LGDPPC	-0.2270**	-0.2301**	0.6361***	0.1319	1		
LOER	0.0113	0.0604	0.0609	-0.1662*	-0.0611	1	
LVAM	-0.6206***	0.1516	-0.417***	-0.396***	-0.113	0.1310	1

\*\*\*, \*\* and \* significant at 1%, 5% and 10% level of significance, respectively

**Table A4.** Pairwise correlation results between CI and FDI for various economies.

Variable Country	Correlation coefficient between concentration Index and FDI
Cameroon	-0.1911**
CAR	-0.5795***
Chad	-0.5562**
Congo	0.5164**
Equatorial Guinea	-0.4238*
Gabon	-0.3503

\*\*\*, \*\* and \* significant at 1, 5 and 10% level of significance, respectively. A. Cameroon B. Central Africa Republic.



**Figure A1.** Scattered plot of relationship between FDI and concentration Index for CEMAC economies. Source: Author



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