Keynesian multiplier and limits to the accumulation: An Input-Output analysis

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This article deepens the Keynesian multiplier's effect on the income generated by final demand stimulus and the repercussion of the new value added on the final demand dynamization. Furthermore, the limits of the companies' accumulation generated for these dynamics and the possibility of inflation are analyzed. A new input output methodology is proposed. This methodology articulates Keynes' multiplier idea, the division of economic agents and their correspondent consumption's and saving's behavior proposed by Kalecki and Shaikh's classical economist's interpretation related to the limits to the accumulation. At first, the model is presented for a closed economy and without government, then is extended to a general model that incorporated the external and the public sector. The model is applied to El Salvador's economy using the 2014 Input-Output Table obtained through the transformation of the 2014 Supply and Use Table published by the Central Bank of El Salvador with the Eurostat's B model. The article's novelties are the possibility to calculate the sectorial Keynesian multipliers; the limits to the final demand stimulus; the model gives new approaches to understand in a better way the paradox of saving; the more general case of this model allows the analysis of fiscal policy and external sector effects.

Key words: Keynesian multiplier, input output analysis, limits to the accumulation

1. Introduction

The input output analysis has been focused on the calculation of the type I and II multipliers. Even though in the income's multipliers' calculation is acknowledge the importance of the final demand's stimulus impact over the income (Miller & Blair, 2009), and even though Keynes' huge influence over Leontief's approaches; the are only a few other approaches[1] that has been accomplished to calculate the Keynesian multipliers using the input output table. This mean that there are a few deepen studies of the effect generated over the household consumption from and income increase calculated with the type II multipliers. For these reasons, the second section of this paper presents an approach for the sectorial Keynesian multipliers' calculation, taking up Keynes' (2017) and Kalecki's (1995) ideas. At first, a closed economy and without government's scenario will be study, where only the working-class consumes its income. Then, the more general scenario will be study, with the external sector, the government and considering the possibility of saving.

The third section studies, from a multisectoral approach, the limits to the production's stimulus from the final demand's shocks explained through the limits to the accumulation process on the short run proposed by Shaikh (2016) for the aggregate macroeconomy. Even though the neoclassical and Keynesian theories suggest that the labor is the main limitation on the short run and that, as getting closer to the full employment the demand's stimulus could caused inflation, Shaikh propose that the limit is the companies' surplus to be reinvested. Moreover, this section consolidates these approaches with the formation of Ricardo's natural prices or Marx's prices of production and their relationship with the savings paradox.

On the forth section, these approaches are empirically applied using the Input Output Table (IOT) from El Salvador for 2014, calculated through Eurostat B model with the Using and Supply Table published by the Reserve Central Bank. The IOT considers 70 products, therefore, to provide an easier analysis, it has been aggregated to three sectors. Finally, the last section presents the conclusions.

2. Keynesian multiplier: An input-output analysis

The multiplier study by the aggregate macroeconomics refers to the impact that the income's changes have over the new demand (Dornbusch, Fisher & Startz, 2009). On the other hand, the type I and II multipliers refer to the inputs' dynamization of the economy's sectors and the income´s or employment's increase caused by the demand's stimulus. However, these multipliers don't refer to the demand's increase multiplying effect caused by the income's increase of the economic agents.

[1] Some of the authors that has deepen over this subject are Trigg & Lee (2005), Dndokow (2011) and de Mesnard (2018); on the following we will present their approaches.

Some authors have previously studied the existing relationship between the Keynesian multiplier and the input output analysis. For example, Trigg & Lee (2005) proved that it was possible, form a Pasinetti's multisectoral model, aggregate a genuine macroeconomic multiplier, without having to assume the existence of only one commodity. However, Pasinetti doesn't propose the link between his model and Keynes' approaches. In that spirit, Trigg and Lee analyze a multiplier that includes complex intersectoral relationships, and it can be aggregated in concordance with the Keynesian approaches. For this process, the authors assumed that there is no enterprise-class in the economy, and therefore there are no categories such as the surplus, using a pure labor value theory.

On the other hand, Dondokov (2011) holds that the input output models, especially those that have a Leontief's framework, consider the consumption as a vector. Dondokov propose to study this consumption as a matrix, based on a new classification for the household's consumption. By using this methodology, is possible to have a better calculation for the sectorial multipliers.

Besides, de Mesnard (2018) holds that the input output models turn the household consumption as endogenous regarding the products resulting from the type I and II multipliers, where the household's final demand of each commodity is endogenous to its own product. The author proposes to turn the household's consumption endogenous regarding the incomes. From this, he presents a "Leontief-Keynes model" by introducing an industrial/sectorial – household circuit. Thus, he shows that the macroeconomic effects of the Keynesian multiplier are not applied uniformly for all the sectors, even though the average effect from all the sectors is equivalent to the aggregate effect of the Keynesian multiplier.

The paper we present propose the study of the Keynesian multiplier using an input output structure, considering the existence of two classes in the economy: the working-class and the enterprise-class, and their own consumptions depends on the wage and the surplus, respectively. Moreover, the limits to the accumulation are analyzed, from the investment requirements presented from the final demand's and added value's stimulus.

To make the analysis easier, this paper starts on the Keynesian multiplier's deduction on a closed economy without government, where the enterprise-class saves all its income and the working-class consumes all of it. Afterwards, some of these assumptions will be more flexible.

2.1. Closed economy and without government

The starting assumptions to build the model are:

1) There are only two social classes: working-class and enterprise-class.
2) The added value is divided between these two classes.
3) The working-class consumes all its income.
4) The enterprise-class' income is entirely saved.
5) The technology is fixed.
6) The is no external sector.
7) The is no government.
8) At first, the inventories for all the sectors are equal to zero.

On the other hand, regarding the labor use, Von Neumann's (1945 – 1946)[2] approaches will be considered, where the available employment is unlimited, in other words, this is not a restriction for the economy's expansion. This assumption is plausible in economies with high levels of labor underutilization such as the Latin-American economies.

Several economists have focused the study of the multiplier effect generated in the economy in front of a dynamization of the variables that comprise the demand. For example, the multiplier analyze by Keynes (2017) refers to the result of the income's changes and the new demand generated from this effect.

On the other hand, the production multiplier calculated with the Leontief (1953) inverse refers to the inputs' dynamization of the several sectors in the economy that are reflected in the final demand. Thus:

$$\Delta Y = \Delta DF + T_1 + T_2 + \cdots + T_\infty \tag{1}$$

Where:

ΔDF = vector (nx1) of final demand's exogenous stimulus

[2] Dadayan (1980) analyses Von Neumann's model adding employment restrictions.

T_t = round i generated for the final demand's stimulus in the moment t

ΔY = vector (nx1) of income's change generated by the final demand's initial stimulus.

In other words, on the initial moment, the final demand increases exogenously. But this demand increase generates a production increase, which requires certain quantity of employment, like is reflected in the equations system (2), where this equation is similar to Dadayan's (1980) approaches.

At the same time, the employment increase pushes the wages up on the moment one, and this income increase for the working-class results in a new consumption, which means new production and new labor requirements, generating the multiplying effect propose by Keynes (2017), but besides with similar characteristics to Kalecki's (1995) approaches, particularly in terms of the class division that realizes the sectorial consumption, which generates the income's multiplier effect:

$$\begin{gathered} T_0 = \Delta DF \\ T_1 = d'[\overline{w}a_n(I-A)^{-1}\Delta DF] \\ T_2 = d'[\overline{w}a_n(I-A)^{-1}T_1] \\ T_3 = d'[\overline{w}a_n(I-A)^{-1}T_2] \\ \vdots \end{gathered} \tag{2}$$

Where:

d' = vector (nx1) of consumption's proportions[3]

$\overline{w}$ = vector (1xn) of sectoral average wage

a_n = vector (nx1) of vertically integrated labor requirements

$(I-A)^{-1}$ = matrix (nxn) Leontief inverse

Thus, is possible to define a matrix (nxn) C like this:

$$C = d'[\overline{w}a_n(I-A)^{-1}] \tag{3}$$

[3] This sectorial consumption vector could reflect and heterogenous household demand system, like Kim, Kratena & Hewings (2014) propose for the case of Chicago, considering the differences between households. However, is not the focus of attention on our study to consider these differences.

Substituting (3) in the equation system (2):

$$\begin{gathered} T_0 = \Delta DF \\ T_1 = C^1 \Delta DF \\ T_2 = C^2 \Delta DF \\ \vdots \\ T_\infty = C^\infty \Delta DF \end{gathered} \tag{4}$$

Thus, is clear that on the infinite:

$$\Delta Y = (1 - C)^{-1} \Delta DF \tag{5}$$

From the matrix obtained on (5) is possible to calculate the Keynesian sectorial multipliers. If we define $K = (1 - C)^{-1}$, then the multiplier ($\propto$) foe the sector j is equal to:

$$\propto_j = \sum_{i=1}^{n} k_{ij} \tag{6}$$

As de Mesnard (2018, p. 23) points out, is not possible to determinate a Keynesian multiplier for the whole economy, because the impact on the production generated for the final demand increases will depend of which of the sectors are dynamized, the higher the demand that goes into the sectors with high wage's levels and high labor requirements is.

2.2. Keynesian multiplier, government and the external sector

Until now we have assumed a closed economy and no government. Lifting this assumption, the final demand's increase will have a portion that corresponds to the imports, therefore, doesn't have impact on the local economy's dynamization, and it must be removed. Thus, rewriting with government and external sector[4]:

[4] Including the external sector also offers external savings for the accumulation process. However, the effects of this situation are beyond of this paper's reach.

$$T_0 = [\Delta DF] \tag{7}$$
$$T_1 = d'\left[\overline{w}(I - \langle t\rangle)\langle a_n\rangle(I - A)^{-1}\left[(I - M_f)\Delta DF\right]\right]$$
$$T_2 = d'\left[\overline{w}(I - \langle t\rangle)\langle a_n\rangle(I - A)^{-1}\left[(I - M_f)T_1\right]\right]$$
$$T_3 = d'\left[\overline{w}(I - \langle t\rangle)\langle a_n\rangle(I - A)^{-1}\left[(I - M_f)T_2\right]\right]$$
$$\vdots$$

Where:

M_f = vector (nx1) of final imports proportions with respects to the final demand
$\langle t\rangle$ = diagonalized matrix (nxn) of direct taxes proportions

It may be noticed on the equations system (7), that the added value's portion that goes to taxes is not considered, and neither the final imported goods' portion.

In this case, the matrix C would be defined like this:

$$C = d'\left[\overline{w}(I - \langle t\rangle)\langle a_n\rangle(I - A)^{-1}(I - M_f)\right] \tag{8}$$

The sectorial multipliers would be expressed in accordance with the expression (6).

2.3. Keynesian multiplier, government, the external sector and the enterprise-class

Now, if the enterprise-class is incorporated to the analysis, it would have the following effects, starting from a demand's exogenous stimulus on the initial period:

$$T_0 = \Delta DF \tag{9}$$

From this stimulus, on the following round the labor is dynamized, which, in accordance to the productivity, stimulates the economy's added value. A portion of this added value is saved by the enterprise-class, while the rest is consumed in accordance to the vector d' of the expression (2), which in turn stimulates the final demand, generating an iterative effect on the following rounds.

$$T_1 = d'[\pi(I - \langle t \rangle)(I - \langle s' \rangle)\langle a_n \rangle (I - A)^{-1}(I - Mf)\Delta DF] \tag{10}$$

Where:

π = vector (1xn) if sectoral productivity
$\langle s' \rangle$ = diagonalized matrix (nxn) of the saving proportions with respects to the added value

Defining the matrix C considering the enterprise-class' saving (C_K):

$$C_K = d'[\pi(I - \langle t \rangle)(I - \langle s' \rangle)\langle a_n \rangle (I - A)^{-1}(I - Mf)] \tag{11}$$

This iterative process can be summarized on the following expression, showing the stimulus generated on the income from the final demand's dynamization:

$$\Delta Y = (1 - C_K)^{-1}\Delta DF \tag{12}$$

Is possible to define $K^k = (1 - C_K)^{-1}$. Therefore, the multiplier of the sector j that considers the enterprise-class saving is defined:

$$\propto_{j\ j}^{k} = \sum_{i}^{n} k^k{}_{ij} \tag{13}$$

3. The limits to the accumulation and to the demand stimulus

From the previous section the possibility of generating demand's stimulus for encourage the production and employment is presented. However, the demand can't increase unlimited since there are limits to the capitalist accumulation process. According to Shaikh (2016), the principal limit is the possibility of reinvestment of the capitalists. To systematize Shaikh's proposal for a multisectoral model, is necessary to calculate in the first instance the added value VA_t generated by the demand's increases on the moment t:

$$VA_t = \hat{\pi}\widehat{a_n}(I-A)^{-1}C_K\Delta DF \tag{14}$$

After this, is necessary to calculate the inputs that are going to be used by each economic sector from the new demand on the moment t (ΔK_t)[5]. Since the added value is known and is assumed a fixed technology, is possible to deduce the vector of the raw material necessary to satisfy the new demand of each sector, using the Gosh (G) matrix and its inverse:

$$\Delta K_t = G(I-G)^{-1}VA_t \tag{15}$$

In a similar way, is necessary to calculate the amount of increase of the wages in the moment t (ΔW_t) from the next equation:

$$\Delta W_t = \hat{w}\widehat{a_n}(I-A)^{-1}C_K\Delta DF \tag{16}$$

These increases of inputs and wages must be anticipated on the productive process, therefore, to accomplish it, they depend on the saving (S) made by the enterprise-class on the previous period. For this the diagonalized matrix of the saving proportion must be multiplied by the column vector of the added value of the previous period[6]:

$$S = \langle s' \rangle VA_{t-1} \tag{17}$$

This implies that the portion saved by the enterprise-class of each sector doesn't have to coincide with the demand's requirements -although the enterprise-class makes its own projections and adjusts its production thought time-. Besides, the bigger the saving needed for the enterprise-class to satisfy the

[5] To make easier the model's analysis, it has been assumed that the enterprises don't operate using their full installed capacity, therefore, in front of demand's increases, is not necessary to increase the capital stock. If the analysis would be developed considering changes in this stock, it would be enough to use the matrix of capital coefficients presented by Leontief (1953, p. 57) and by Dadayan (1980, p. 103).

[6] The saving is presented as a proportion of the total added value to make easier the mathematical expression. However, it's assumed for plausibility that only the enterprise-class in the one that saves.

demand -the required saving could exceed 100%- is, the higher the prices of the products are, since the enterprise-class would face the impossibility to increase the production more once its participation on the added value is totally reinvested. Shaikh (2016) points out that this is the main productive limitation of capitalism, and not the employment availability that the Neoclassical and Keynesian schools assume[7]. Thus, for the sector j:

$$S^j \gtreqless \Delta K_t{}^j + \Delta W_t{}^j \tag{18}$$

In case that the accumulation for the sector j is bigger that the inputs and wages requirements for the same sector to satisfy the final demand, inventories will be accumulated, and this will provoke a fall in prices. In the opposite case, if the demand of inputs and wages to satisfy the final demand exceed the saving of the capitalist class, the inventories would start to run out and this will provoke a price increase. Duménil & Lévy (1987) propose a general disequilibrium model in which the prices move on a similar matter. Considering this idea and applying it to the model presented in this paper:

$$P_t{}^j = P_{t-1}{}^j G^j\left(\frac{\Delta K_t{}^j + \Delta W_t{}^j}{S^j}\right) \tag{19}$$

Where $P_t{}^j$ represents the prices of the sector j in the moment t. The prices depend on the prices' level of the previous period and on a function G^j that depends positively on the ratio of input/wages requirements and the saving of the enterprise-class on the sector j.

The previous equation assumes that the enterprise-class of each sector will invest exclusively on the sector in which it is initially. However, according to the classical economist, the enterprise-class would move to the sectors that offers the highest rates of profit[8]. Therefore, the previous equation would be express as following:

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[7] As it has been previously pointed out, Von Neumann (1945-1946) assumes unlimited labor. On the other hand, Dadayan (1980, p. 104) includes the restriction of the available labor. Even though this paper doesn't focus on the scenarios in which the labor is a limitation, on a more general scenario it would be enough to include the restriction $a_n(I-A)^{-1}Y \leq L$, where L is the total of available labor.

[8] The classical economists refer to a ratio of profit that considers the capital stock, in other words, the relation between paying wages, inputs and capital stock with the surplus or gross operating surplus. For this, for the calculation of the sectoral ratio of profit is necessary information of the sectoral capital stock or the matrix of capital

$$P_t{}^j = P_{t-1}{}^j G^j \left(\frac{\Delta K_t{}^j + \Delta W_t{}^j}{S^{\to j}\left(r_{t-1}^j\right)} \right) \quad (20)$$

Where:

$$\left[\sum_{j=1}^{n} S^j = \sum\nolimits_{j=1}^{n} S^{\to j} \right] \leq \sum_{J=1}^{n} GOS^j \quad (21)$$

$S^{\to j}$ represents the accumulation that goes to the sector j, coming form enterprises from all sectors and is a function that keeps a positively relation with the surplus rate (r) of that sector on the previous period (t-1). Is clear that this will provoke that those sectors with higher surplus rates, when new enterprises enter and have higher accumulation, they will experience a reduction on their prices in regarding with the rest of the economy, since the technology is fixed and so are the average wages, which would imply a surplus' reduction and, therefore, of the surplus rate in regarding with the average surplus rate.

In the opposite case, the sectors with lower surplus rates will have lower accumulation levels, which would provoke prices increases if the demand has also increase, which would imply increases on the surplus rates of this sectors in regarding with the rest of the economy. This would provoke that the surplus rates gravitate to one and the generated prices in their equality are Ricardo's (1959) natural prices or Marx's (1981) prices of production.

As Duménil & Lévy (1987) point out, the gravitation around the prices of production is a trend and is not equivalent to an equilibrium. This is because of movements on the technologies, the wages, access to information, the restrictions of free entrance and exits of enterprises, etc. Additionally, the previous equation also offers answers to explain the saving paradox. The lower the marginal propensity to save is, the higher the multiplier effects from the demand's stimulus are, since the enterprise-class will consume a bigger proportion of its income. However, the lower the marginal propensity to save is, the lower the limit to the accumulation is, and the lower the capacity of the enterprise-class to make front to the

coefficients presented by Leontief (1953, p. 57). This is an important limitation since the national accounts normally present the sectors that have demand of capital stock (gross formation of fixed capital), but they don't present which sectors are the ones demanding.

demand's stimulus is. In the case where the accumulation of the enterprise-class is not enough to cover the inputs and labor requirements, the final demand's stimulus will provoke higher prices, and not increases on the production's level. Also, these situations could happen on employment's levels far from full employment. Once more, the limit to the final demand's stimulus is not the full employment level, but the accumulation made on the previous period by the capitalist class.

On the other hand, the inequation (21) points out that the saving and the accumulation of the enterprise-class (without importance of which sector they belong, and they reinvest), cannot exceed the gross operating surplus (GOS) of the whole economy. In aggregated terms, this implies that the prices of the period t P_t depend on the accumulation requirements in regarding with the gross operating surplus available to be reinvested on the whole economy of the previous period (GOS_{t-1}). The higher the reinvestment requirements in regarding with the whole gross operating surplus are, the higher the prices:

$$P_t = P_{t-1} G \left(\frac{\Delta K_t + \Delta W_t}{EBE_{t-1}} \right) \tag{22}$$

Finally, the previous equation explains when an increase on the wages could means an increase on the prices (or not). An increase on the wages implies that any demand's stimulus will imply a higher level of labor accumulation, which could provoke a general increase of prices if the accumulation ratio increases high enough.

4. Empirical application: El Salvador 2014

The methodology described and studied on the previous sections will be empirically applied for El Salvador's economy, using the Input Output Table (IOT) for 2014, which has been calculated from the Supply and Use Table published by El Salvador's Reserve Central Bank (BCR, 2018), using Eurostat (2008) B model. Besides, on the same Supply and Use Table the sectorial occupation vector is presented.

Also, this information is presented for 70 products for the whole salvadorian economy. However, an aggregation to three sectors will be used[9]. This OIT is presented in the following:

[9] This aggregation corresponds to then ex classification: **agricultural sector**, form product 1 to 10; **industrial sector**, from product 11 to 43; **services sector**, from product 44 to 70.

Table 1. Input Output Table (IOT). El Salvador, 2014. Millions of US$

	Agr.	Ind.	Ser.	HC	Ex	GC	I	CI	X
Agr.	144	1194	164	986	163	3	33	98	2785
Ind.	533	4778	2975	7982	3281	197	3024	67	22837
Ser.	180	1869	6660	9052	2347	3517	15	0	23641
W	618	2086	7558						
T-S	120	561	-1273						
GOS	695	2973	6535						
M	495	9376	1022						
X	2785	22837	23641						

Labor[A/]	0.5289	0.5418	1.7851

Note: Arg. represents agriculture; Ind. represents industry; Ser. represents services; HC represents household consumption; Ex represents exports; GC represents government consumption; I represents investment; CI represents changes in inventories; X represents gross value of production; W represents wages; T-S represents taxes minus subsidies; GOS represents gross operating surplus; M represents imports.

A/ Labor is measured in millions of workers.

Source: own elaboration based on BCR (2018) and Eurostat (2008).

4.1. Closed economy and without government

To observe the impact of an increase on final demand of one million US$ on the agricultural sector, is presented on the table 2 the rounds generated from this increase, in accordance with the equations system (2). For the calculation of the vector d', it has been used exclusively the proportion of household consumption (HC) of each sector in regarding with the total of this consumption.

Table 2. Vector of household consumption proportions and round generated from the stimulus of one million US$ on the final demand of the agricultural sector. El Salvador, 2014. Millions of US$

a) Vector of household consumption proportions

	HC	d'
	986	0.05472324
	7982	0.44293429
	9052	0.50234247
Suma	18020	1

b) Rounds generated from the stimulus of one million US$ on the final demand of the agricultural sector

Sector	ΔDF (T_0)	T_1	T_2	T_3
Agr.	1	0.01665322	0.00566421	0.00192655
Ind.	0	0.13479247	0.04584654	0.01559364
Ser.	0	0.1528714	0.05199566	0.01768512
Generated Wage Bill	0.30431708	0.1035064	0.0352053	0.01197427

Sector	T_4	T_5	T_6	Total
Agr.	0.00065527	0.00022288	7.5806E-05	1.02519792
Ind.	0.00530381	0.00180397	0.00061358	0.20395401
Ser.	0.00601518	0.00204593	0.00069587	0.23130916
Generated Wage Bill	0.00407277	0.00138526	0.00047116	

Source: own elaboration

In this case, there are only six rounds presented, and their respective totals. The aggregation of these totals, which is equal to **1.4605**, represents the Keynesian multiplier of the agricultural sector until the sixth round. For the calculation of the sectorial multipliers, as it was deduced on the equations (5) and (6), from the summarize by column of the matrix $(1-C)^{-1}$ the sectorial Keynesian multipliers ($\propto_j$) are obtain including all the rounds:

$$(I-C)^{-1} = \begin{bmatrix} 1.025237 & 0.015371 & 0.039848 \\ 0.204270 & 1.124411 & 0.322535 \\ 0.231668 & 0.141098 & 0.728178 \end{bmatrix}$$

$$\alpha = [1.461175 \quad 1.280880 \quad 1.728178]$$

4.2. Economy with government and external sector

Incorporating the external sector and the government, according with the equation (8), and assuming that t = 0.25 for all sector, and considering the final imports' proportions for each sector[10], generating the next matrix:

$$(I - \langle Mf \rangle) = \begin{bmatrix} 0.701003 & 0 & 0 \\ 0 & 0.624867 & 0 \\ 0 & 0 & 0.992785 \end{bmatrix}$$

With these considerations, the matrix C is modified, generating the following multipliers:

$$\alpha = [1.206968 \quad 1.112364 \quad 1.462818]$$

Just like the aggregated case (Dornbush, et al., 2009), the multipliers decrease for each of the sectors after incorporating the external sector and the government in the analysis. For example, the agricultural multiplier drops 0.2542 units. This is because a portion of the demand's stimulus goes to imports, and another portion goes to paying taxes.

4.3. Economy with government, external sector and enterprise-class

Finally, the enterprise-class will be considered, in the case where they consume a portion of their income. For this, on the calculation of C_K, the equation (11) is used, which contemplates a portion for saving in regarding with the sectorial income (s'). Besides, instead of using the wages, the labor productivity must be contemplated. For the empirical analysis, the sectorial productivity will be assumed as the summarize of the gross operating surplus and the wages, all as a proportion of the number of workers in each sector; the proportion for savings will be assumed as 0.1 for all sectors. Therefore, the sectorial multipliers are generated as following, multipliers that are higher that the ones previously presented, since the stimulus generated by the enterprise-class consumption:

$$\alpha = [1.507904 \quad 1.293250 \quad 2.016398]$$

[10] These proportions were calculated from the IOT total and domestic for 2014. They are the proportion of final consumption that the households import.

4.4. The limits to the accumulation

The demand's stimulus analyzed on previous sections can contribute to increase the production and the employment. However, as it was pointed out on the third section, this depends on the enterprise-class capacity of accumulation from the gross operating surplus of the previous period, which is shown in the table 1. From equations (15) to (18), is possible to calculate the inputs and waged requirements that must be paid by the enterprise-class. On table 3, a hypothetical case is assumed with the following demand stimulus (ΔDF_t):

Table 3. Stimulus simulations on the final demand and their accumulation requirements. Millions of US$

Sector	GOS_{t-1}	ΔDF_t	ΔK_t	ΔW_t	$\Delta K_t+\Delta W_t$	Accumulatio rate
Agr.	695.0058	5000	627.0323	75.06746	702.0998	101.02%
Ind.	2972.971	4000	536.5606	213.7929	750.3535	25.24%
Ser.	6534.831	6000	732.6364	831.5496	1564.186	23.94%

Source: own elaboration

On the agricultural sector, for example, the final demand's stimulus generate accumulation requirements equals to US$ 702.0998 million; which represents an accumulations rate of 101.02%, and therefore the gross operating surplus of the same sector (695.0058) cannot make front to it. In the case that there is no accumulation coming from other sectors, this will provoke inflationary effects, just as equation (19) points out. On the other hand, in the industry and services sectors, the accumulation will be significantly lower, which implies that their prices will decrease in regarding with the agricultural prices[11].

Moreover, as it has been pointed out in equation (20), the enterprise-class would move to the sectors with higher surplus rates. Therefore, to analyze the inflationary effects is convenient to observe the relationship between the inflation and the accumulation rate for the whole economy. For El Salvador's case, information from 2005 to 2014 is available, presented in table 4:

[11] This doesn't mean that there is a deflation process in these sectors, simply that the inflation would be lower that the one presented in agriculture.

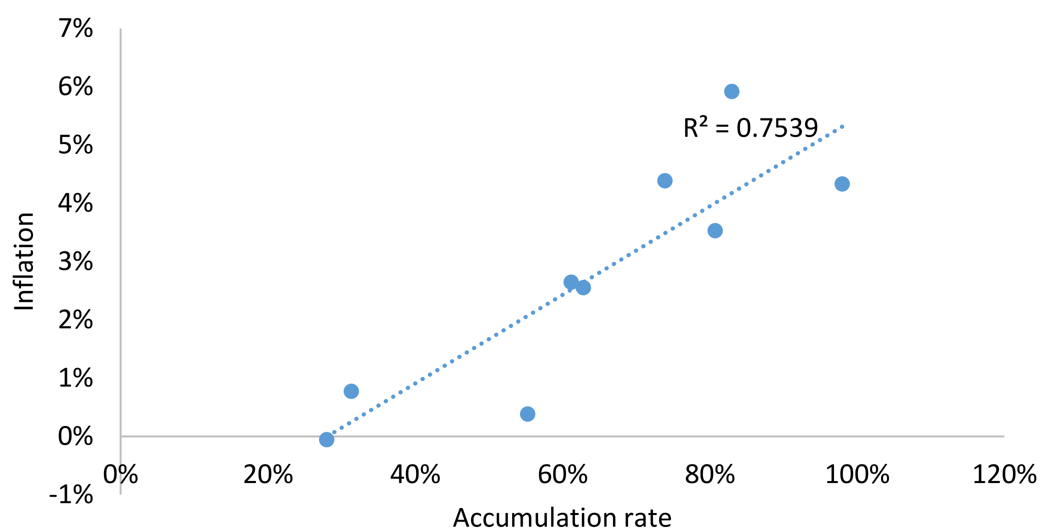
Table 4. Gross operating surplus, accumulation requirements, accumulation rate and inflation. El Salvador, 2005 - 2014. Millions of US$

Year	GOS	ΔK+ΔW+ΔFK	Accumulation	Inflation
2005	5359.48	N/D	N/D	N/D
2006	5966.49	5251.53	98.0%	4.3%
2007	6644.3	4408.79	73.9%	4.4%
2008	6987.48	5362.56	80.7%	3.5%
2009	6637.36	1954.65	28.0%	-0.1%
2010	6944.87	4058.85	61.2%	2.6%
2011	8001.13	5763.48	83.0%	5.9%
2012	8669.65	5025.88	62.8%	2.5%
2013	8611.08	4789.01	55.2%	0.4%
2014	8673.35	2695.66	31.3%	0.8%

Source: own elaboration based on BCR (2019)

For the calculation of the accumulation requirements, the differential from the gross value of production of each year with the gross value of production of the year before, discounting the increases of the gross operating surplus. Besides, the increases on the fixed capital (ΔFK) registered by the national accounts were added.

Graphic 1. Correlation between accumulation rate and inflation. El Salvador, 2005-2014



Source: own elaboration based on BCR (2019)

The calculation of the accumulation rate uses the accumulation requirements of the period t, and the gross operating surplus of the previous period, as equation (22) points out. The inflation was calculated with the implicit index prices. Even though there is information available for only a few years, the graphic 1 shows a strong correlation between the accumulation rate and the inflation, just as it was deduced from equation (22)[12].

5. Conclusions

The analysis made on this paper allowed the calculation of the sectorial Keynesian multipliers in an input-output framework. As in the aggregate macroeconomics, the propensity to save, the taxes and the imports are inversely related with the multiplier. Furthermore, even though boost in the demand could improve the economic growth and the employment, there is a limit for this that is linked with the capacity of the accumulation of the enterprise-class. The sector with a higher accumulation rate (including the accumulation that came from other sectors) will show a higher inflation, in the long run this explain the prices of production of the classical political economy.

For the Salvadorian economy of 2014, it has been use the input output tables and several scenarios to show the impact of agents such as the government and the external sector, as well as the respective impacts of the working-class and the enterprise-class. In all the scenarios analyzed, the services sector presented the highest multiplier for a US$1 million stimulus, followed by the agricultural sector and at least the industrial sector. These results show that, in the case of El Salvador, is exactly the services sector the one that generates the biggest dynamization on the income from a final demand's stimulus, showing its importance on the salvadorian productive structure.

In other words, the multiplying effects depend of the specific sector that is dynamized, since there are differences between the sectors regarding on the labor requirements that they need, as well as different average sectoral wages. These differences, along with other interindustry dynamics' own characteristics from each sector, generates specific multipliers for each sector, just as the results demonstrated.

[12] To deepen on the analysis, and assuming that in the short term there is no enterprise's movement between sectors, is possible to relate the accumulation rate and the sectorial inflation if input output tables from two consecutive years are available. At the moment of writing this paper, El Salvador only had Supply and Use Tables for the years 2005 and 2014, and it was impossible to make this analysis.

On the other hand, considering the government and the external sector, al the sectorial multipliers are reduced, since a portion of the demand's stimulus is canalized to imports and to taxes imposed by the fiscal policy. However, when the enterprise-class is included in the model, higher sectorial multipliers are obtained, consequence of the stimulus generated by the consumption of this class.

Besides, on an hypothetical case of final demand's stimulus on each sector, it was possible to calculate the accumulation rate generated by these stimulus, rates that, when compared to the gross operating surplus showed on 2014 by each sector, some of them wouldn't be able to make front to this accumulation, generating inflationary processes higher than other sectors that would be able to make front. This differentiated impact would provoke that the enterprise-class moves to the sectors with higher surplus rates, increasing the quantity of enterprises in these sectors and more accumulation, finally resulting in a decrease of the sectorial surplus rate. On the opposite case, the sectors with lower initial surplus rates, would have lower accumulation, generating at the end an increase in their surplus rates. In general, all surplus rates will gravitate to one, demonstrating the relevance on the approaches of the prices' formation from authors such as Ricardo and Marx.

Finally, it was proved, from the accumulation requirements presented by the salvadorian economy from 2005 to 2014, the existence of a strong correlation between the accumulation rate and the inflation in this country, empirically demonstrating Shaikh's (2016) approaches, in which, from this relation, is established that is the accumulation rate the one that determinates the limitation to the productive dynamics on the capitalist system.

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