Commodity Booms, Human Capital, and Economic Growth. An Application to Colombia

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Abstract

In this paper we model the idea that a trade-off exists between the current level of consumption and the future levels of human capital. As shocks in the international prices of commodities affect current income and modify the optimal consumption basket, households adjust their preferences between schooling time and working time for the household members. Therefore, the dynamics of human capital accumulation can be affected and, with it, the prospects for economic growth and the sectorial composition of the economy, when commodity production and trade play a significant role in the economy.

JEL: C68, I25; J24; O13

Keywords: Commodity Booms; Human Capital; CGE modeling, Colombia.

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List of abbreviations
1. Introduction

In this paper we study the mechanisms through which the boom on commodities prices affect the economic growth via human capital accumulation. The motivation for this research is the open discussion about the role of natural resources in an economy. There are two different perspectives about this topic, one which consider the positive effects on economic growth and another which contemplate negative effects, but no one of these is conclusive. We consider the relation among commodities boom, human capital accumulation and economic growth in light of the Colombian economy.

Colombia has had a boom in the production of commodities since 2009. The high prices on mining-energetic products have promoted the production of this sector, and at the same time, have driven growth in some complementary sectors. In particular, the services sector has received some stimulus form this bonanza. Figure 1 shows the importance of the mining sector in Colombian GDP after the international financial crisis. However, figure 2 is more illustrative to show the commodity boom between 2009 and 2015 through the share of sectors in total exports for the Colombian economy.

Figure 1: Sectorial production volume index for the Colombian economy (2005=100)

Source: DANE
There is a wide literature about natural resources effects on economic growth. From the optimistic perspective classical economist as Smith and Ricardo, and more recently Viner (1952) and Rostow (1961) suggest that natural resource abundance support economic development. From the other side, authors as Sachs and Warner (1995, 1997), Gylfanson (2001) Gylfason and Zoega (2006), among others, propose that natural resource abundance could affect economic growth through different channels as savings, investment and human capital accumulation, Badeeb, et.al. (2017)

The mechanism between the boom on commodities and the human capital accumulation is presented from the demand side. The greater levels of income could diminish the agents' incentives to accumulate human capital (Badeeb, et.al. 2017). Some empirical evidence in this context is presented by Gylfason et. al. (1999) and Gylfason (2001) who found a reduction in the school enrollment at every levels when the natural resource dependence is greater. Other studies than present this inversely relation between commodities boom and human capital accumulation are: Stijns (2006), Blanco and Grier (2012) and Shao and Yang (2014).

Most specifically the mechanism may be presented as follow: trying to take advantage of expansive periods (with higher general income from non-wage incomes or commodities-based wages), households reduces its demands for education at the expense of human capital formation. In this direction, Santos (2014) shows the implications of gold boom on child labor and school attendance in Colombia. According to this paper, the gold boom decreases school attainment in 0.2 standard deviations in Colombia during the recent bonanza. Other papers as Kruger (2007) shows how the education of poor and middle-

\[\text{Figure 2: Share by sectors in total Colombian real exports}\]
income children may be adversely affected in the periods of economic growth for the case of coffee production in Brazil.

There is a clear link between human capital and schooling as human capital is “the component of education that contributes to an individual’s labor productivity and earnings” (Son, 2010, p. 2). There is a sizeable set of empirical studies documenting a positive relationship between human capital and economic growth. For example, Azariadis and Drazen (1990) show that the literacy rate is significant in determining per capita GDP growth, while Mankiw, Romer, and Weil (1992) find relatively large elasticities of per capita GDP to enrollment rates. Barro and Lee (2010) also find an elastic response of per capita GDP to an additional year of schooling of the labor force.

Nonetheless, there is a body of literature that asserts that the causality runs in the opposite direction as economic growth increases the returns to education and this, in turn, increases people’s willingness to study and attain a higher educational level. This is the point in the works of Bils and Klenow (2000), which claim that the effect noted above has been erroneously enhanced due to omitted variable bias, and Krueger and Lindahl (2001), that claim that cross country studies do not control in an appropriate way for policies that are not stationary and lack valid instrumental variables.

From the schooling to growth perspective, increases in child labor rates and, in general, the increase in drop-out rates from the school system, lower the dynamics of human capital accumulation and this hinders economic growth. From the growth to schooling perspective, economic growth that does not increase the return to years of schooling would have a negative effect on human capital accumulation. These relationships lay the ground for an inquiry into the dynamics of human capital accumulation in a context in which returns to schooling are determined by the general equilibrium effects of sectorial growth and its associated demand for different types of labor (different schooling years), while human capital accumulation is affected by household decisions tied to current income and schooling decisions, that feed-back to economic growth.

We aim to analyze this issue by means of a recursive dynamic general equilibrium model that encompasses a schooling module that allows for keeping track of human capital formation and accumulation, as will be explained in the methodology section.

In light of the above, our main research questions can be summarized as follows:

• What is the effect of commodity price shocks on human capital accumulation at the economy-wide level?

• How do these effects feed-back into the composition of the labor force in terms of the distribution of their years of schooling?

• How does the (changing) composition of the labor force interact with the demand for labor?

• What does this interaction imply at the sectorial level?

• What is the effect of the dynamics of human capital accumulation on GDP growth in the medium term?
2. Data

We build a Social Accounting Matrix (SAM) for Colombia using 2014 data from Colombian national accounts to run the CGE model. The economy is classified in the following 11 economic activities: Agriculture, Mining, Primary sector, Other industries, Industry, Refinery and metals, Services, Financial services, Other services, Educational services, and Public administration. Additionally, the factors are split into capital and 9 categories of labor. Labor is divided according to the level of skill (Unskilled: non-educated workers, Basic skilled: basic educated workers, and Skilled: who has achieved post-primary levels of education) and the households are classified according to their geographical localization (rural, urban and metropolitan areas) based on Colombian National Home Survey (Gran Encuesta Integrada de Hogares - GEIH) and the Livelihood Survey (Encuesta Nacional de Calidad de Vida- ENCV) for 2014 (See Annex 2 for more details about these surveys).

It is useful to employ the macro data to provide a summary of the Colombian economy that allows for a better understanding of its structure and some of the features relevant for our study. In this regard, table 1 provides a sectoral breakdown of the economy, in terms of value added shares, export and import. From the data in table 1 it can be appreciated that services account for the bulk of the economy (59.8% of value added in total), while the mining sector represents around 9% of value added and agriculture 3.8% respectively. Mining is the most important sector for exports representing around 55% of total exports for 2014, followed by Refinery and metals with 19%. The mining-energetic sector add around 75% of total exports in Colombian economy. On the import side, Industry 49% and Refinery and metals 37% gather the most of total imports.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Value added share</th>
<th>Export share</th>
<th>Import share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>3.81</td>
<td>3.85</td>
<td>3.29</td>
</tr>
<tr>
<td>Mining</td>
<td>9.25</td>
<td>54.65</td>
<td>0.18</td>
</tr>
<tr>
<td>Primary sector</td>
<td>4.30</td>
<td>2.12</td>
<td>3.27</td>
</tr>
<tr>
<td>Other industries</td>
<td>1.22</td>
<td>6.76</td>
<td>3.31</td>
</tr>
<tr>
<td>Industry</td>
<td>3.25</td>
<td>8.52</td>
<td>49.01</td>
</tr>
<tr>
<td>Refinery and metals</td>
<td>6.16</td>
<td>18.77</td>
<td>31.68</td>
</tr>
<tr>
<td>Services</td>
<td>30.59</td>
<td>2.99</td>
<td>0.67</td>
</tr>
<tr>
<td>Financial services</td>
<td>12.28</td>
<td>1.87</td>
<td>8.07</td>
</tr>
<tr>
<td>Other services</td>
<td>16.93</td>
<td>0.47</td>
<td>0.53</td>
</tr>
<tr>
<td>Education services</td>
<td>5.15</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Public administration</td>
<td>7.05</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Source: Authors elaboration based on Colombian SAM

In relation to the factor participation in total sectoral value added Table 2 shows factor shares intensities according to the factors classification. It is possible to appreciate that Mining and Refinery and metals are the most capital intensive sectors while Agriculture
and Primary sector are intensive in unskilled and basic skilled labor. The other sectors, mainly related to services are intensive in skilled labor.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Unskilled</th>
<th>Basic skilled</th>
<th>Skilled</th>
<th>Capital</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>7.1</td>
<td>41.0</td>
<td>37.1</td>
<td>14.7</td>
<td>100</td>
</tr>
<tr>
<td>Mining</td>
<td>0.0</td>
<td>1.3</td>
<td>12.6</td>
<td>86.0</td>
<td>100</td>
</tr>
<tr>
<td>Primary sector</td>
<td>4.4</td>
<td>22.6</td>
<td>42.3</td>
<td>30.8</td>
<td>100</td>
</tr>
<tr>
<td>Other industries</td>
<td>0.4</td>
<td>6.4</td>
<td>51.1</td>
<td>42.2</td>
<td>100</td>
</tr>
<tr>
<td>Industry</td>
<td>0.2</td>
<td>6.0</td>
<td>66.5</td>
<td>27.3</td>
<td>100</td>
</tr>
<tr>
<td>Refinery and metals</td>
<td>0.1</td>
<td>1.6</td>
<td>21.5</td>
<td>76.7</td>
<td>100</td>
</tr>
<tr>
<td>Services</td>
<td>0.7</td>
<td>9.2</td>
<td>50.4</td>
<td>39.8</td>
<td>100</td>
</tr>
<tr>
<td>Financial services</td>
<td>0.1</td>
<td>1.3</td>
<td>57.9</td>
<td>40.6</td>
<td>100</td>
</tr>
<tr>
<td>Other services</td>
<td>0.4</td>
<td>5.1</td>
<td>40.1</td>
<td>54.4</td>
<td>100</td>
</tr>
<tr>
<td>Education services</td>
<td>0.0</td>
<td>1.1</td>
<td>89.9</td>
<td>9.0</td>
<td>100</td>
</tr>
<tr>
<td>Public administration</td>
<td>0.0</td>
<td>1.2</td>
<td>86.7</td>
<td>12.1</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Authors elaboration based on Colombian SAM

Before making simulations of policies considering home location (rural, urban and metropolitan areas), we disaggregate a representative home expenditure in rural, urban or metropolitan. We used the ENCV to disaggregate savings and consumption of SAM's homes. Next, we calculated representative consumption baskets for each kind of household; we first reclassified survey's expenditure items into the accounting system used by SAM; and then, we added all home expenditures for each SAM's item. Finally, we estimate participation of different homes in total survey's expenditures; those values are used to obtain separately consumption vectors of each type of household.

<table>
<thead>
<tr>
<th>Households</th>
<th>Unskilled</th>
<th>Basic Skilled</th>
<th>Skilled</th>
<th>Capital</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural</td>
<td>3.92</td>
<td>20.40</td>
<td>18.25</td>
<td>57.43</td>
<td>100</td>
</tr>
<tr>
<td>Urban</td>
<td>1.02</td>
<td>8.85</td>
<td>79.31</td>
<td>10.82</td>
<td>100</td>
</tr>
<tr>
<td>Metropolitan</td>
<td>0.69</td>
<td>9.82</td>
<td>80.71</td>
<td>8.79</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Authors elaboration based on Colombian SAM

In addition, we specified income distribution among types of household, considering geographical location (Rural, Urban and Metropolitan areas). Then, we calculated remunerations for three types of work: Unskilled, Basic skilled and Skilled (see Table 3). Table 3 shows that the main source of income for urban and metropolitan households comes from skilled labor while in rural households the earnings come from capital. Besides the earlier, direct transfers from other institutional sectors were distributed to households according to the share receive by everyone; those transfers were calculated based on the GEIH.
3. The methodology

For attaining the objectives listed above, we will use a recursive dynamic applied general equilibrium model. In particular, we start with the single country, static version of the Partnership for Economic Policy (PEP) model, fully documented in Decaluwé et al (2012). We extend to multiple periods the single-period PEP-1-1 model, by linking successive periods through a set of variables that are inherited from the previous one and transmitted to the following one by a set of “dynamic equations”. The model is developed under neoclassical framework. Since, as mentioned, the model has a thorough documentation, we do not expand here in describing it. Instead, we focus on the changes we plan to introduce in order to achieve our objectives.\(^2\)

The main change we introduce to the model has to do with household’s behavior. While in the standard setting households’ endowments of production factors are exogenous to the household, and (aside from transfers) their income is given once salaries and capital rents are determined in equilibrium, we follow Jung and Thorbecke (2003) in making human capital endogenous to the household decision making process. In this context, households decide every period how much they demand of education services and, consequentially, how much they increase the future human capital levels in the form of their stock of skilled workers.

Hence, we posit that there is a trade-off between schooling decisions and current household income. In the face of potentially higher relative wages for unskilled workers, households may decide to stop the school cycle of some of their members in return for higher current income to the detriment of future human capital (skilled labor). We aggregate the sectorial composition of the economy to 11 production sectors as we shown in the data section. Additionally, we consider three labor categories unskilled, basic skilled and skilled workers,\(^3\) while including three household types depending on their geographical location (rural, urban and metropolitan areas).

On the production side, we assume that production depends on the composition of labor force among skilled, basic skilled and unskilled labor. The quality and extent of human capital formation will be computed as the product of the interaction by schooling decisions made by the households from their income maximization problem, the initial endowments of human capital, and the government and households expenditure on education.

In this framework, as the household can endogenously modify the composition of its labor force (among skilled, basic skilled and unskilled components) it at the same time decides on its current income level given the different wages for each category of labor and the costs associated to education. Therefore, assuming, as in Jung and Thorbecke (2003), that transversality conditions hold, households maximize utility given the maximization of their lifetime incomes. As shocks in the international prices of commodities can affect current income by changing relative wages, households adjust their optimal choosing of schooling time for their younger (school-aged) household members. As follows, this decision-making

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\(^2\) See annex 1 for the details about the modification of PEP-1-1 v2.1 model.

\(^3\) We define basic skilled workers as those who have studied the basic primary cycle (5 years of scholarly).
at the household level can affect the dynamics of human capital accumulation for the economy at large and, potentially with it, the prospects for economic growth (especially when commodity production and trade plays a significant role in the economy).

The household optimization problem can be described as follows. In the first stage, agents maximize their lifetime income choosing between getting a higher level of education or keeping the same education level and work. Higher educational levels bring higher expected wages in the next period while the same educational level provides the same expected wage. In this sense, the children that work provide a new short run income source for the household. The second stage is the standard household utility maximization problem subject to the intertemporal budget restriction.

At the aggregate level, the total labor force \( L_{h,t} \) is the sum of each category of labor, which are the consequence of the income maximization problem of households.

\[
L_{h,t} = L_{u,h,t} + L_{bs,h,t} + L_{s,h,t}
\]

Following Jung and Thorbecke (2003) the decision variable in the household’s income maximization problem is the expected wage for the increase of education level in relation to the present wage for the educational level achieved at the moment. Under these assumptions, households have two possible income paths depending on their choice about study or work. If the members of the household decide to increase their education level, their expected income will be:

\[
Y_{t}^{edu} = f_{t}^{h} \sum_{t=1}^{T} W_{t-1}^{edu} (1 + g)(1 - T) \left( \frac{1 + g}{1 + r} \right)^{s}
\]

Alternatively, if they do not decide to study:

\[
Y_{t}^{w} = W_{t-1}^{w} (1 + g)(1 - T) + \sum_{t=1}^{T} W_{t-1}^{w} (1 + g)(1 - T) \left( \frac{1 + g}{1 + r} \right)^{s}
\]

where \( Y \) is the expected income path, \( f_{t}^{h} \) is a variable that summarizes the availabilities to obtain education services, \( W_{t-1}^{edu} \) is the expected salary for the next level of education, \( W_{t-1}^{w} \) is the salary for the present level of education, and \( g \) and \( r \) are economic growth and interest rates respectively.

The agent’s decision depends on the relative income between the two expected income paths. In this way, an agent decides to study if the expected income is greater than the expected income of continuing working, \( Y_{t}^{edu} > Y_{t}^{w} \). It means the educational choice depends on the relative wages and the availabilities to get access to educational services:

\[
f_{t}^{h} \geq \left( \frac{W_{t-1}^{w}}{W_{t-1}^{edu}} \right) \left( \frac{(r - g) + [1 - ((1 + g)/(1 + r))^{T}]}{(1 + g) \left[ 1 - ((1 + g)/(1 + r))^{T} \right]} \right)
\]

\(^4\) The additional assumptions are that the wage growth rate is equal to the economic growth rate \( g \) and the discount rate is equal to the interest rate \( r \).
Income maximization determines the household’s budget constraint, and once determined, the household optimally chooses its consumption levels of all goods through the utility maximization problem.

The dynamics of the labor endowment in the model is governed by population growth. New children are born at rate \( n \), which we assume constant, so \( L_{t+1} = L_t(1 + n) \). Population from the previous period become either skilled, basic skilled or unskilled laborers depending on the income maximization problem of the households and add to their corresponding labor stocks. Therefore, the dynamics of population growth is interlinked among the different labor categories and is determined in the following way. The new population is allocated between people belonging to the basic education level and uneducated people. From the basic education population some proceed to the labor market and the rest to the higher education group. Finally, people from the higher education level enter into the labor market as skilled workers.\(^5\)

### 4. Application and results

Based on the model presented above we simulate the impacts on labor composition and education demand for an increase in the international export price of the mining sector. We simulate a shock of 25% in the exports of mining commodities. The shock goes in the same direction that the real shock that affected the Colombian economy between 2009 and 2014. In that case, export prices in mining products increased up in an extraordinary way and later returned to historical levels. This extraordinary shock in commodities prices transformed labor composition, and the levels of human capital accumulation in different regions of the country. We want to identify some of these effects through the present simulation.

The simulated scenario is contrasted with the base scenario as comparative framework. The base scenario is established by the initial conditions for the Colombian economy in 2014. Besides, we assume the economy is under stable growth path defined as the potential economic growth rate determined by the economics authorities in Colombia (average 4.9%).

The simulated shock of 25% in export prices of mining products starts in 2019 and presents persistence for the rest 6 years producing dynamic implications. The shock would affect the relative wages between the different categories of labor and consequently the household decision on education, affecting in this way the levels of human capital and economic growth. The final effect will depend on the demands for the different kinds of labor by the distinct economic sectors and the government decision in terms of transfers to households for education.

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\(^5\) For more details, see Annex 1 and Jung and Thorbecke (2003)
4.1 Main macroeconomic results

In this section we present the results of the main macroeconomic variables after the shock on the international prices of mining commodities. The shock on simulation scenario starts in 2019 with an increase of 25% on mining export prices. The table 4 summarizes the shock effects on some macroeconomic variables as percentage changes with respect to the base scenario.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP</td>
<td>0 0 0 0 0 0 25 25 25 25 25 25</td>
</tr>
<tr>
<td>Consumption rural</td>
<td>0 0 0 0 0 0 4.13 4.22 4.35 4.47 4.51 4.48 4.51</td>
</tr>
<tr>
<td>Consumption urban</td>
<td>0 0 0 0 0 0 2.49 2.54 2.57 2.60 2.64 2.69 2.72</td>
</tr>
<tr>
<td>Consumption metropolitan areas</td>
<td>0 0 0 0 0 0 2.38 2.42 2.44 2.46 2.51 2.57 2.60</td>
</tr>
<tr>
<td>Real exchange rate</td>
<td>0 0 0 0 0 0 -7.50 -7.71 -7.90 -8.10 -8.31 -8.53 -8.73</td>
</tr>
</tbody>
</table>

Real GDP at basic prices, Consumption: final consumption
Source: CGE model simulation

The international price shock directly affects production in the country. This positive shock on the mining-energetic export prices increases the GDP for Colombia given the importance of the sector in the national production. The greater export prices in the sector increase the investment in the sector which is reflecting in greater capital stock and greater production given the intensity in capital for mining production. Additionally, the greater production in the mining sector push the production of complementary sectors as services which expand the positive effect on GDP. The positive shock effects on GDP persist in time which could be attributed to the specialization of the economy in the production of these commodities.

On the consumption side, the greater income in the country generated by the shock increases the income of the different kinds of households in the economy, because of the spillovers from production in the mining-energetic sector. The greater income of households reflects on greater consumption. Although all households increase their consumption, rural households show the larger increases in consumption. This is because the rural areas have the greater proportion of unskilled labor and the relative wage of unskilled labor grows the most after the shock in relation to the other labor categories (this mechanism will be explained wide in the next section). The shock effects on consumption also have time persistence.
As is frequent in economies with large commodities sectors, a shock on international prices in this kind of products has a direct effect in the exchange rate. In this particular case the appreciation of the real exchange rate is significant. This is an important level of appreciation which has direct implications on the terms of trade, sectorial composition and trade balance of the economy.

Figure 3 presents the variation on production, exports and imports by sector after the shock. The results show some evident effects on output and external sector after the raise in the export prices of the mining commodities. The mining sector increases its production because of the better international conditions for selling its products. At the same time, the greater production in the mining sector drives up other sectors, particularly services, education and, to a lower degree, the primary sector. The rest of sectors reduce their production as a result of the new allocation of resources inside of the economy.

The new composition of the external sector is a direct consequence of the shock. The only sector that increases its exports is the mining sector. The other sectors reduce their exports because of the large appreciation of real exchange rate which deteriorates the terms of trade and therefore the participation of the rest of sectors in the international market. This is the classical effect generated by the boom in the production based on natural resources.

Imports are greater in all sectors all years. The lower exchange rate makes imports cheaper and this reflects in an increase in imports for all sectors. The larger increases belong to the mining, services, and financial sectors. These increases affect domestic production as is usual after commodities boom in economies with high dependence on natural resources.
It is important to underline that the education sector increases its production as a consequence of the shock because the intensity of the mining sector in terms of skilled labor and the income effect that grows education demands by households. This is a central result for the next section in which we analyze the shock’s impact on labor composition and households demands for the different levels of education.

4.2 Results on education and labor composition

We present in this section the results on education and labor variables in the simulated and base scenario. First, we show the results separately, and later we discuss how these are defined simultaneously. Figure 4 displays the main results on the demand for education by each household type after the shock in international prices.

As is evident in the Figure, all households have a similar behavior in their education demands. The most pronounced change occurs in rural areas. From one hand, because these areas have the greater proportion in unskilled labor and after shock the greater demands are for skilled labor. On the other hand, employment in the mining sector is strongly linked to that areas. Initially, the shock on commodities prices increase households’ education demands given the income effect generated by the shock and the intensity in skilled labor in the commodities sector. After 5 years, the demands for education are lower due to the relative supply of the different labor categories which is greater in the more skilled categories affecting the relative wages in favor of unskilled labor. Agents stop the educational cycle and incorporate to the labor force.

Figure 4: Education demands by type of household (% change)

Source: CGE model simulation

On the labor variables side, the effects from the shock are presented in Figure 5 which present the evolution on labor supply on the different labor categories in relation to the base scenario. The greatest effects relate to unskilled labor. After the shock, the supply of unskilled labor is lower given the intensity of skilled labor in the commodities sector that
increase relative wages in favor of skilled labor and the income effect generate by the
greater export prices. However, after 4 periods the last effect is mitigated because the
relative scarcity of unskilled labor that counteract the initial effect on relative wages.
Figure 5: Education demands by type of household

Unskilled labor supply

Basic skilled labor supply

Skilled labor supply


Base  Simulation

Base  Simulation

Base  Simulation
The other two categories of labor show a smoother performance. From one side, the supply of skilled labor increases permanently in a small rate due to the demand from the mining-energetic sector. On the other side, the basic skilled labor reduces its participation in the labor composition because of its lower demand in the commodities sector, the high substitutability it maintains with unskilled labor, and the higher demand for skilled labor form mining sector that motivates the basic skilled workers to study to become skilled workers.

**Figure 6: Relative wages by qualification**

The evolution of wages is the consequence of the relative supply and demand for the different kind of labor in the market (see Figure 6). In the first years after the shock, the greater demand for skilled labor increases the most this kind of salaries because the
growing demand in the commodities sector. The skilled wages fall as the relative supply of skilled labor increases. The basic skilled wages have a similar adjustment than skilled labor. However, the unskilled wages change more abruptly. These decrease in the first years because the higher demand for skilled labor in the mining sector. Then, the unskilled wages grow due to the low supply of this kind of labor force given the better relative wages in the previous years for skilled labor that motivate the workers to study. At the final years, these wages fall again because its greater supply due to the previous better relative wages. The wages have a cyclical behavior given the way in which the agents determine their education demands. Agents observe the prior relative wages and define if study or not, so the relative wages and labor supply by categories are determine simultaneously.

As we said before, both the education decisions and the composition of labor force are simultaneously determined. The shock on international prices induces a new sectoral composition of production, which at the same time modifies the demand for factors of production. The result is a variation in the demands for all types of labor and capital. In the first years the demand for skilled labor grows more that the demand for unskilled and basic skilled labor modifying the relative wages in favor of skilled labor. The greater relative wages for skilled labor motivate the agents to study to become skilled workers. After some time, the greater amount of skilled labor generates an excess of supply of skilled labor reducing its relative wages.

The lower relative wages in terms of skilled labor reduces the demand for education in the different households. The substitution effect dominates the income effect and the agents prefer to work as unskilled labor than to study to become skilled labor, because the low study premium and the greater opportunity cost. This effect persists for some periods and affects human capital accumulation and, at the same time, economic growth rates. Indeed, households' decisions on education demands generates a clear relation between the shock on commodity prices, the levels of schooling, human capital accumulation and economic growth.

The results show how shocks in the international prices of commodities affect current income and modify the optimal consumption basket. Households adjust their preferences between schooling and working. Therefore, the dynamics of human capital accumulation can be affected and, as a consequence, economic growth.

5. Conclusions and policy implications

The Colombian economy has been characterized by the continued importance of commodities production. Some decades ago the coffee production was the main economic activity, and more recently, the oil and mining production has become in the main sector of production for the country. The boom in these markets after international shocks on prices has had direct consequences on productive structure on the country. Particularly, the booms on these sectors modify the demand for labor, and at the same time, affect the demand in other sectors related to these activities, particularly the services sector. This earlier effect determines the labor demands in different zones of the country and at once has implication on the labor qualification, the human capital accumulation, and at the end, on economic growth.
The present research studies the relationship between shocks on international prices of commodities and the labor composition through a computable general equilibrium approach.

The results show the direct relationship between the boom of the commodities sector and the educational demands. The shock on international prices of commodities increases the relative wages between unskilled and skilled labor for some periods, which become in an incentive to drop out the school and take part of the labor force as unskilled or basic skilled workers. Concurrently, the shock increases both the direct and opportunity costs for households of sending their members to study if the government does not adjust their transfer to households for education.

As a result, from the shock, the demand for education from households is lower after some periods and unskilled labor increases its participation in the total labor composition (ceteris paribus). This effect has direct repercussions on the long run human capital formation and economic growth of the economy. Agents that stop the study cycle to start working do not return to school which will go against the skilled labor formation in the country. The greater the schooling drop out the lower the human capital formation and the lower the long run economic growth.

The other direction in which the results from the model could be interpreted is related with government policy actions. The greater the transfers from government to households for education, the lower the cost assumed by households and the lower the schooling drop out (ceteris paribus). It means the government has instruments to promote the education and capacitation for people to seek to ensure greater levels of skilled labor that contribute to the economic growth in the long run.

Despite the fact that results from the model are in terms of the whole economy, the policy recommendations can go in the direction of focusing governmental intervention in particular regions and sectors. The shock on international prices of commodities has significant implications on the economy but its effects can be greatly enhanced on production regions whose economy is more dependent on this kind of goods. Given the latter, the government might concentrate its actions on particular zones in which the shock effects are greater. In this sense, instruments as conditional transfers for education can counteract the shock effect on schooling drop out, and simultaneously, on human capital formation.

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**Annex 1 A Extensions to PEP-1-1 v2.1**

In this annex we present the modifications introduced to the single-country static PEP model PEP-1-1 v2.1. To save space, this appendix assumes familiarity with the original documentation of the PEP-1-1 v2.1 model.
Dynamics: Investment and Capital Accumulation

As it name indicates, PEP-1-1 is a static model. In this paper, we made PEP-1-1 dynamic by following the approach first proposed by Dervis et al. (1982) to allocate new capital among sectors. (Certainly, we could have used PEP-1-t as our starting point. However, all the other improvements we introduced to PEP-1-1 GAMS code made such an alternative less cost-effective.)

In this set of equations we present the model dynamics. Specifically, the mechanisms used to assign each period investment among sectors are presented. As will be shown, a distinction is made between private and public capital stocks; this is particularly relevant given when simulating increases in the government investment of public infrastructure.

For domestic non-government institutions, investment in each period increases the capital stock available in the next period. Then, we need to determine how the new capital is distributed among industries. In our model, for private investment (i.e., households and/or enterprises) we assume that the new capital is distributed among activities based on differences in capital rates of return. Thus, sectors with a relatively higher (lower) capital rate of return receive a relatively larger (smaller) share of the new capital. For the government, investment is determined (1) as a policy variable (i.e., exogenously), or (2) as a residual to balance the government budget.

Equation INV1 computes the average capital rate of return, as the ratio between total capital income and total capital stock. Equation INV2 computes the share of each activity in the new capital stock, following the explanation on the previous paragraph. The $\kappa$ parameter, which varies between zero and one, measures the degree of capital mobility among productive sectors. When $\kappa$ is zero, investment is distributed among sectors only based on the initial share of each sector in the total capital stock. When $\kappa$ is positive, investment is distributed among sectors also based on the relative capital returns. Finally, equation INV3 and INV4 show how sectoral private and public capital stocks are updated, respectively.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>INV1</td>
<td>[ RAVG_{k,t} = \frac{\sum_{j \in J} R_{k,j,t} \cdot KD_{k,j,t}}{\sum_{j \in K} KD_{k,j,t}} ]</td>
</tr>
<tr>
<td>INV2</td>
<td>[ QINVDEST_{k,j,t} = GFCF_{t,REAL} \cdot \frac{KD_{k,j,t}}{\sum_{j' \in J} KD_{k,j',t}} \left[ 1 + \kappa \left( \frac{R_{k,j,t}}{RAVG_{k,t}} - 1 \right) \right] ]</td>
</tr>
<tr>
<td>INV3</td>
<td>[ KD_{k,j,t} = KD_{k,j,t-1}(1 - deprat_k) + QINVDEST_{k,j,t-1} ]</td>
</tr>
</tbody>
</table>

where

- $RAVG_{k,t}$: average capital rent
- $QINVDEST_{k,j,t}$: investment by destination
- $\kappa$: capital mobility parameter
- $deprat_k$: capital depreciation rate

$k \in K$
$t \in T$
$\kappa \in KCAP$
$j \in J$
$t \in T$
## Dynamics: Labor Growth Skill Composition of Labor Force

Equation L1 defines the share of labor type \( l \) in pair of labor categories.
Equation L2 defines the share of labor type \( l \) in pair of labor categories (residual).
Equation L3 defines of total supply of education level first labor category.
Equation L4 defines of total supply of education level non-first labor category.
Equation L5 defines the new entrants to labor market.
Equation L6 defines the wage ratio (or premium).
Equation L7 defines the real spending in education.
Equation L8 defines the Labor supply.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>( SHRSK_{t,t} = SHRSK^{00}<em>t \cdot \left( \frac{WRAT</em>{t,t-1}}{WRAT^{0}<em>t} \right)^{eduelas,wrat</em>{t,wrat}} \cdot \left( \frac{QEDU_{t-1}}{QEDU^{0}<em>{t-1}} \right)^{eduelas,edu</em>{edu}} ) for ( l \in L ) and ( t \in T )</td>
</tr>
<tr>
<td>L2</td>
<td>( SHRSKRES_{t,t} = 1 - \sum_{l \in \text{map}(p(L_t))} SHRSK_{t,t} ) for ( l \in L ) and ( t \in T )</td>
</tr>
<tr>
<td>L3</td>
<td>( MS_{t,t} = (qf acgrw_{labtot,t} + deprat_{t})lstat_{t} ) for ( l \in L ) and ( t \in T )</td>
</tr>
<tr>
<td>L4</td>
<td>( MS_{t,t} = SHRSK_{t,t} \sum_{l \in \text{map}(l,L_t)} MS_{l,t} ) for ( l \in L ) and ( t \in T )</td>
</tr>
<tr>
<td>L5</td>
<td>( ML_{t,t} = SHRSKRES_{t,t} \cdot MS_{t,t} ) for ( l \in L ) and ( t \in T )</td>
</tr>
<tr>
<td>L6</td>
<td>( WRAT_{t,t} = \frac{W_{t,t}}{\sum_{l \in \text{map}(l,L_t)} W_{l,t}} ) for ( l \in L ) and ( t \in T )</td>
</tr>
<tr>
<td>L7</td>
<td>( QEDU_{t} = \sum_{i \in \text{edu}} PC_{i}^{00} \cdot Q_{i,t} ) for ( t \in T )</td>
</tr>
<tr>
<td>L8</td>
<td>( LS_{t,t} = LS_{t,t-1}(1 - deprat_{t}) + ML_{t,t-1} ) for ( l \in L ) and ( t \in T )</td>
</tr>
</tbody>
</table>

Where:
- \( SHRSK_{t,t} \): share of labor type \( l \) in pair
- \( SHRSKRES_{t,t} \): share of labor type \( l \) in pair (residual)
- \( MS_{t,t} \): total supply of edu level
- \( ML_{t,t} \): new incomers of level \( l \) to labor market
- \( WRAT_{t,t} \): relative wage bt \( l \) and \( l' \) (lower)
- \( QEDU_{t} \): real spending in education
- \( eduelas_{l,ac} \): education-related elasticities.
- \( qf acgrw_{labtot,t} \): growth rate factor stocks (total labor and natural resources)
- \( deprat_{t} \): factor depreciation rates
- \( lstat_{t} \): total labor supply (economically active population)
- \( map(l,L_t) \) is mapping between labor categories based on their skill level.

### Exports
In the PEP 1-1 Standard Model, the world demand for exports of product i is (see equation 62 in Decaluwé et al. (2013))

\[ EXD_i = EXD_i^0 \left( \frac{e \cdot PWX_i}{PE_{i,FOB}^e} \right)^{X_0} \]

In case \( \sigma_i^{KD} = \infty \), this equation simplifies to

\[ PE_{i,FOB}^e = e \cdot PWX_i \]

which represents the "pure" form of the small-country hypothesis; producers can always sell as much as they want on the world market at the (exogenous) current price, \( PWX_i \). In our simulations, we assume that \( \sigma_i^{KD} = \infty \). Hence, the domestic (FOB) price of exports is defined as

\[ PE_{i,t}^{FOB} = e_t \cdot PWX_{i,t} \]

**Current Account BoP**

Equation (RW1) defines the current account balance in foreign currency. Equations (RW2) and (RW3) define the index for domestic producer prices and the real exchange rate, respectively. As we be shown, variables CAB_FCU and REXR are used to select the macroeconomic closure rule for the model.

<table>
<thead>
<tr>
<th>RW1</th>
<th>( CAB_{FCU}^{t} = \frac{CAB_t}{e_t} )</th>
<th>( t \in T )</th>
</tr>
</thead>
<tbody>
<tr>
<td>RW2</td>
<td>( DPI_t = \sum_{i \in I} dwts_i \cdot PL_{i,t} )</td>
<td>( t \in T )</td>
</tr>
<tr>
<td>RW3</td>
<td>( REXR_t = \frac{e}{DPI_t} )</td>
<td>( t \in T )</td>
</tr>
</tbody>
</table>

where

- \( CAB_{FCU}^{t} \): current account balance in foreign currency units
- \( DPI_t \): index for domestic producer prices (PL-based)
- \( REXR_t \): real exchange rate
- \( dwts_i \): domestic sales price weights

**Government**

In the PEP Standard Model, government consumption of commodity i is determined by the equation (see equation (55) in Decaluwé et al. (2013))

\[ PC_i \cdot CG_i = \gamma_i^{GVT} \cdot G \]

with G (i.e., current government expenditures on goods and services) fixed and equal to its initial value (i.e., \( G = G^0 \)). As an alternative, we modified the government behavior assuming that the real government spending can be exogenous (i.e., all the \( CG_i \) variables) while \( G \) is endogenous. Specifically, we dropped the previous equation from the model and added equations (G1) and (G2). In addition, we added equation (G3) to define real government savings as the ratio between nominal government savings and the GDP deflator.

<table>
<thead>
<tr>
<th>G1</th>
<th>( CG_{i,t} = cgbar_{it} \cdot CGAD_t )</th>
<th>( i \in I )</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>( G_{i,t} = CG_{i,t} \cdot \gamma_i^{GVT} \cdot \gamma_i^{GVT} )</td>
<td>( t \in T )</td>
</tr>
<tr>
<td>G3</td>
<td>( RGS_{i,t} = \frac{NS_{i,t}}{G_{i,t}} )</td>
<td>( t \in T )</td>
</tr>
</tbody>
</table>
\[
G_2 \quad G_t = \sum_{i \in I} PC_{i,t} \cdot CG_{i,t} \quad t \in T
\]

\[
G_3 \quad SG_t^{REAL} = \frac{SG_t}{PIXGDP_t} \quad t \in T
\]

where

- \( CG_{ADJ,t} \): adjustment factor for CG
- \( cgbar_{i,t} \): base-year CG(i)
- \( SG_t^{REAL} \): real government savings

**Tax Rates**

By the default, in PEP-1-1 the government can clear its government budget by adjusting savings (variable \( SG \)) or current government expenditures on goods and services (variable \( G \)). Thus, to allow for changes in the household income or commodity tax rates to clear the government budget, we added equations \( T1 \) and \( T2 \).

\[
T1 \quad TTDH1_{h,t} = ttdh1bar_{h,t} \cdot TTDHADJ_t \quad h \in H \quad t \in T
\]

\[
T2 \quad TTIC_{i,t} = tticbar_{i,t} \cdot TTICADJ_t \quad i \in I \quad t \in T
\]

where

- \( TTDHADJ_t \): adjustment factor for \( TTDH1_{h,t} \)
- \( TTICADJ_t \): adjustment factor for \( TTIC_{i,t} \)
- \( ttdh1bar_{h,t} \): exogenous (base-year) \( TTDH1_{h,t} \)
- \( tticbar_{i,t} \): exogenous (base-year) \( TTIC_{i,t} \)

**Household Savings**

By default, PEP-1-1 assumes that investment is savings-driven. In other words, the marginal propensities to save for non-government institutions are fixed while investment clears the savings-investment balance. In contrast, our model allows imposing the opposite assumption. To that end, equation (SH) defines the marginal propensity to save of households. Its structure is the same as that of equations \( T1 \) and \( T2 \) for tax rates and \( G1 \) for government consumption. In fact, whether \( MPSADJ \) is flexible depends on the closure rule for the savings-investment balance.

\[
SH \quad sh1_{h,t} = sh1bar_{h,t} \cdot MPSADJ_t \quad h \in H \quad t \in T
\]

where

- \( MPSADJ_t \): savings rate scaling factor
- \( sh1bar_{h,t} \): exogenous (base-year) \( sh1_{h,t} \)

**Calibration using Employment by Sector**
In PEP-1-1 it is assumed that all sectors pay the same wage. In the extended PEP-1-1, the analyst can complement the SAM with data on number of workers by sectors. To do so, the remuneration to labor type \( l \) paid by the activity \( j \) is computed as

\[
W_{t,j} \cdot \text{wdist}_{t,j} (1 + \text{triw}_{t,j})
\]

where \( \text{wdist}_{t,j} \) is a “distortion” factor applied to for labor type \( l \) in industry \( j \) that allows modeling cases in which the factor remuneration differs across activities. In other words, each activity pays an activity-specific wage that is the product of the economy-wide wage and an activity-specific wage (distortion) term. To calibrate \( \text{wdist}_{t,j} \), the model dataset must provide physical labor quantities. In implementing this extension, the following equations of the original model were modified.

\[
YHL_h = \sum_l A_{h,l} \sum_j W_{j} \text{wdist}_{t,j} LD_{t,j} \quad h \in H \text{ and } t \in T
\]

\[
TIW_{t,j} = \text{triw}_{t,j} W_{t,j} \text{wdist}_{t,j} LD_{t,j} \quad l \in L; j \in J \text{ and } t \in T
\]

\[
YROW = e \sum_i PWM_i IM_i + \sum_k A_{row,k} \sum_j R_{k,j} KD_{k,j} + \sum_l A_{row,l} \sum_j W_{j} \text{wdist}_{t,j} LD_{k,j} + \sum_{agd} TR_{row,agd} \quad t \in T
\]

\[
W_{t,j} \cdot \text{wdist}_{t,j} (1 + \text{triw}_{t,j}) \quad l \in L; j \in J \text{ and } t \in T
\]

\[
GDP_{IB} = \sum_{l,j} W_{j} \text{wdist}_{t,j} LD_{t,j} + \sum_{k,j} R_{k,j} KD_{t,j} + TPORDN + TPRCTS \quad t \in T
\]

**Wage Curve**

The single period-model PEP-1-1 assumes full employment. We introduced endogenous unemployment through a wage curve. We add the equation (WC) and the variable (endogenous) UERAT (unemployment rate). The value of the wage curve elasticity was set at -0.1 based on international evidence (See Blanchflower and Oswald, 2005). Of course, the equilibrium condition for labor market was adjusted accordingly (see equation 85).

\[
(WC) \quad \frac{W_{l}}{PIXCON} = \frac{WO_{l}}{PIXCON} \left( \frac{UERAT}{UERATQ} \right)^{\text{phillips}(l)}
\]

\[
(85) \quad LS_{l} (1 - UERAT) = \sum_{j} LD_{t,j}
\]

where

- \( UERAT(l) \) = unemployment rate for type \( l \) labor
- \( phillips(l) \) = elasticity of real wage with respect to unemployment rate
Annex 2 Surveys summary

The GEIH is aimed to produce basic information about size and structure of country’s labor force (employment, unemployment and income). It also measures general aspects of people surveyed, such as housing, access to public services, social protection, gender, education, among others. That information is available for country, state, region and municipality levels, and is collected monthly for the whole nation and 13 cities; quarterly for 24 cities or metropolitan areas; biannual for regions; and annual for states.

Table 5: Colombian National Home Survey - GEIH

<table>
<thead>
<tr>
<th>Information</th>
<th>Source: Gran Encuesta Integrada de Hogares (GEIH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General description of the source</td>
<td>The Gran Encuesta integrada de Hogares (GEIH), is a survey that solicits information about the employment conditions of people (do they work, what do they work for, how much do they earn, if they have social security in health or if they are looking for work), in addition to the general characteristics of the population such as gender, age, marital status and educational level, it is asked about their sources of income. It is a probabilistic, multistage, stratified sampling survey of unequal and self-weighted conglomerates (for the twenty-four capital cities with their Metropolitan areas)</td>
</tr>
<tr>
<td>What is the level of coverage of the data provided there? (National, Regional, city)</td>
<td>The GEIH provides the country with information at the national level, headrest, regional, departmental, and for each of the capitals of the departments. The disaggregation of the results of the GEIH in turn are: Monthly: Total National and, total 13 cities Quarterly: National Total by head, rest and cities or metropolitan areas. Semestral: Regions Anual: Departments.</td>
</tr>
<tr>
<td>What is the sample size / records available?</td>
<td>Approximately 62,000 households are visited annually (30,000 households in 13 areas, 14,400 in the Rural Zone and 17,500 in 11 cities).</td>
</tr>
<tr>
<td>What internal indicators are used for quality control?</td>
<td>Indicators of Reliability (Coverage of Homes and Households) and Quality (Response Rate) that ensure the quality of the collection and the precision</td>
</tr>
<tr>
<td><strong>What is the level of statistical significance?</strong></td>
<td>With the current sample for the current GEIH it is possible to estimate, on average, statistically significant variations of 1.5 percentage points of the monthly unemployment rate, with 95% confidence.</td>
</tr>
<tr>
<td><strong>Methodology used.</strong></td>
<td>For people 10 years and older, a direct informant is accepted. For people 10-17 years old who are not working or are not looking for a job, a suitable informant is accepted as well as for people who have disabilities and cannot answer the survey themselves. No information should be accepted from employees of domestic service, retired, neighbors or minors, except when the minor is the head of the household or spouse.</td>
</tr>
<tr>
<td><strong>What reports / studies are derived from the information?</strong></td>
<td>Press release, monthly statistics bulletin and website: <a href="http://www.dane.gov.co">www.dane.gov.co</a></td>
</tr>
<tr>
<td><strong>How often are reports generated? (Both from the source itself, as of the reports / studies)</strong></td>
<td>Monthly since August 2006. The information collection period is weekly for the 32 cities with their metropolitan area and monthly for head and rest.</td>
</tr>
<tr>
<td><strong>Who are the users of the information?</strong></td>
<td>Research centers</td>
</tr>
<tr>
<td><strong>Where is the information available to be consulted?</strong></td>
<td><a href="http://www.dane.gov.co">www.dane.gov.co</a></td>
</tr>
<tr>
<td><strong>Who is responsible for processing the data?</strong></td>
<td>Dirección de Metodología y Producción Estadística DIMPE- DANE</td>
</tr>
<tr>
<td><strong>What are the requirements that must be done to access?</strong></td>
<td>An account must be created on the DANE website (without cost) and specify the purposes of the investigation. The anonymity of the respondents must be guaranteed.</td>
</tr>
</tbody>
</table>

Source: Own elaboration

The ENCV is an important referent to collect indicators of social and economic phenomena which support research and policy making. It provides data about home’s socioeconomic issues, e.g. shares of home expenditures in different sectors. The survey covers the national and regional levels of the country, including eight regions: Antioquia, Pacífico, Centro, Oriente, Atlántico, Bogotá-Soacha, Orinoquia-Amazonia, y San Andrés y Providencia (see Annex 2 for more details).
<table>
<thead>
<tr>
<th>Information</th>
<th>Source: Encuesta Nacional de Calidad de Vida</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General description of the source</strong></td>
<td>This research quantifies and characterizes the living conditions of Colombians including variables related to housing (material of walls, floors and public services), people for which variables of: education, health, childcare, strength of work, expenses and income, etc. are included, and households that involve variables such as: possession of assets and perception of the boss or spouse on living conditions in the home.</td>
</tr>
<tr>
<td><strong>What law or regulations apply for the construction of the survey?</strong></td>
<td>Confidentiality policy: Law 79 of 1993. Copyright Law (1032 of 2006)</td>
</tr>
<tr>
<td><strong>How is the information recorded?</strong></td>
<td>The information is recorded by the pollster on mobile storage devices with the supervision of an official. Subsequently, it is consolidated and sent to the DANE headquarters in Bogotá where it is validated according to quality criteria.</td>
</tr>
<tr>
<td><strong>What internal indicators are used for quality control?</strong></td>
<td>Coverage indicators. Response rate. Quality of the collection. Indicators of errors and inconsistencies. Alarms: High number of vacant homes, high number of rejections, low average of people, among others.</td>
</tr>
<tr>
<td><strong>What is the level of coverage of the data provided there?</strong></td>
<td>The survey is significant at the national level, head-rest. 9 regions Antioquia, Pacífico, Centro, Oriente, Atlántico, Bogotá-Soacha, Orinoquia-Amazonía, and San Andrés y Providencia.</td>
</tr>
<tr>
<td><strong>(National, Regional, city)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>What is the size of the sample / records with which it is counted?</strong></td>
<td>21.383 homes nationwide.</td>
</tr>
<tr>
<td><strong>What is the level of statistical significance that it used?</strong></td>
<td>For the rural area, error occurred in 7% of the estimates. In urban area it is 5%. The level of significance is 95%.</td>
</tr>
<tr>
<td><strong>Methodology used.</strong></td>
<td>Multipurpose interview with an average duration of 1.5 hours per interview. Collection of information on mobile devices. The information is collected between September and October with prior sensitization to households and training to the interviewers. The average performance of the pollster is 7 daily...</td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>What reports / studies are derived from the information?</td>
<td>Press releases, press bulletins containing the general results at the national and regional levels. Annexes with more specific information on the website</td>
</tr>
<tr>
<td>How often are reports generated? (Both from the source itself, as of the reports / studies)</td>
<td>1993, 1997, 2003, 2008 y yearly since 2010.</td>
</tr>
<tr>
<td>Who are the users of the information?</td>
<td>Research centers</td>
</tr>
<tr>
<td>Where is the information available to be consulted?</td>
<td>The information with the metadata and the questionnaires for the different modules are available on the website of the institution.</td>
</tr>
<tr>
<td>Who is responsible for processing the data?</td>
<td>Dirección de Metodología y Producción Estadística DIMPE-DANE.</td>
</tr>
<tr>
<td>What are the requirements that must be met to access?</td>
<td>An account must be created on the DANE website (without cost) and specify the purposes of the investigation. The anonymity of the respondents must be guaranteed.</td>
</tr>
</tbody>
</table>

Source: Own elaboration.