Commodity Price Shocks, Factor Intensity and Non-primary Production Growth: Evidence from Colombia

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Abstract

This paper studies the differential effects of commodity price fluctuations on non-primary production. I build a simple multisectoral model of price shocks that is used to derive several predictions. These predictions motivate the empirical strategy that leverages *i)* variation across municipalities (counties) in the suitability to produce coffee and historical patterns in oil production; and *ii)* temporal differences in commodity prices. The results show that, for a municipality with the median suitability to grow coffee, an exogenous increase in the growth rate of internal coffee price in a standard deviation leads to a reduction in the growth rate of per-capita industrial production of 0,28 standard deviations. On the other hand, in the municipality with a median historical production of oil (conditional on producing at all), the effect is a small but positive increase in industrial production (0.007 standard deviations). The effects on the non-tradable sector, services, in this case, are both positive but small in magnitude (0.03 and 0,001 standard deviations for coffee and oil, respectively). Furthermore, I show that these heterogeneous effects on industry growth are stronger in municipalities with export-oriented industries. I argue that these results are in line with the model's predictions and point to the fact that, to understand the effects of commodity price shocks on other economic sectors, is important to consider the technology used in production and the degree of openness in industrial sectors.

Key Words: Industry, Services, Coffee, Oil industry, Commodity prices.
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1 Introduction

Developing economies tend to be specialized in commodities exportation[1]. This fact makes this economies vulnerable to commodity price fluctuations especially when the commodity accounts for a big part in total exports and overall employment (Fernández, Schmitt-Grohé, & Uribe, 2017; Kohn, Leibovici, & Tretvoll, 2021; Drechsel & Tenreyro, 2018). Additionally, economist and social scientist, in general, have developed theories that points to a negative relationship between resource dependence and structural transformation. For example, Dutch Disease theory holds that commodity price booms harms other tradable sector's competitiveness effecting long run economic growth (Nülle & Davis, 2018).

Thus, it is no a surprise that researchers have been focused in the effects and transmission channels of commodity price shocks in other sectors growth and employment. A important question is, therefore, through which channels are the effects of commodity price shocks transmitted? Early theoretical literature has argued for the existence of a cost effect: and increase in wages that crowds out other tradable sectors (Corden & Neary, 1982). Empirical literature has found evidence that highlight the importance of this mechanism (Benguria, Saffie, & Urzua, 2020; Adão, 2016; Pelzl & Poelhekke, 2021; Alberola & Benigno, 2017)

Nevertheless, recent empirical research has found positive effects of resource booms on other sector's employment and production (Allcott & Keniston, 2018; Aragón & Rud, 2013; Cavalcanti, Da Mata, & Toscani, 2019). Motivated by this contradictory findings I incorporate the well known Stolper-Samuelson theorem into a model of commodity price shocks and show that depending on factor intensity a increase in commodity prices can lead to positive effects on other tradable sectors. Furthermore I test the model in the Colombian case and find evidence that supports this theory.

In the model, wages rise (fall) if the price of the labor-intensive (capital-intensive) commodity rise[2]. This would imply that other tradable sectors (the industrial sector, in this case) would lose (gain) competitiveness. Thus, coffee price booms will decrease industrial production, while increasing oil prices will increase industrial growth. For services production, the model predicts null effects since this sector can react to increases (or falls) in wages by modifying the price they charge.

To motivate the empirical strategy, the model also predicts that the effect of commodity price shocks on wages will be stronger in economies with high productivity to produce that commodity. This motivates the use of coffee suitability and oil historical production as a measure of exposition to commodity price shocks. Additionally, the model extends the traditional theoretical literature on resource booms,

[1]United Nations Conference on Trade and Development (UNCTAD) classifies countries as commodity-dependent if the share of commodities exports in total exports is bigger than 60%. According to this institution, while only 13,2 % of the developed countries were commodity dependent, for transition and developing economies this percentage was 50% and 66 %, respectively, in the period 2018-2019 (UNCTAD, 2021).

[2]This result is known as Stolper Samuelson's theorem (Stolper & Samuelson, 1941) and is one of the most important results of international trade theory (Jones, 1965).

which do not account for differences in factor intensities and productivity between different commodities (Corden & Neary, 1982), allowing for richer conclusions

The empirical strategy leverages two sources of plausibly exogenous variation. The first is variation between municipalities in the suitability (potential yield) to grow coffee and historical oil production. The second is temporary variation in the price of coffee and oil. Since Colombia is one of the main coffee producers, the price paid to coffee growers may respond to some extent to local conditions (Dube & Vargas, 2013). For example, coffee internal price may depend on innovation and investment in the quality of Colombian coffee[3]. If innovation trends respond to factors that also affect positively industrial or service growth, the OLS estimator would be positively biased. Given this, I leverage export variations of three other large producers (Brazil, Indonesia, and Vietnam) to obtain exogenous variations in coffee internal price.

The results of applying this identification strategy support the model predictions. For a municipality with suitability to grow coffee equal to the median, an increase of one standard deviation in the growth rate of coffee internal price (a labor-intensive sector) decreases the growth rate of the industrial GDP (per capita) by approximately 0.28 standard deviations. In the case of the oil sector (capital-intensive), I find a positive but modest effect equivalent to 0.007 standard deviations, for a municipality with an oil production equal to the median (across oil-producing municipalities). Additionally, the estimated effects of price shocks on the services sector are not statistically significant and smaller, in absolute value, that these for the case of industry growth (0.03 and 001 standard deviations for coffee and oil, respectively). I show that the results are robust to several specifications, including changes in the definition of the instrument.

Finally, I present evidence about the mechanism behind these estimates documenting that coffee and oil price shocks affect industry growth more heavily in municipalities with a large employment share in export-oriented industrial sectors. As a placebo exercise in the case of service growth, I show that these differential effects are not present. I argue that these findings are in line with the mechanism suggested by the theoretical model as long as it explains the negative effect of coffee price shocks stemming from industries that cannot modify the price they charge because of international competition.

This research contributes to several strands of literature. First, I contribute to the empirical literature about the local effects of resource price chocks (Allcott & Keniston, 2018; Cavalcanti et al., 2019). I focus in local economies, municipalities, in the Colombian context, and found positive effects of oil price booms over industry growth. Second, this research contributes to the extensive literature that analyzes the effects of coffee price shocks on economic results (Miller and Urdinola, 2010; Carrillo, 2020; Kruger, 2007, for example). Furthermore, I contribute to the research on the relationship between coffee production and industrial growth. For the long run Uribe-Castro (2021), leveraging potential yield (suitability) measures

[3]For example, in 2009, the final period of the main analysis, the premium for Colombian coffee was at a historical level- compared to previous years (Semana, 2009)

for coffee production and discontinuities in probability to produce coffee at different altitudes, finds that municipalities that in the early XX century produced coffee tend to have less industrial employment in 1945, 1973, and 2005. I find that in the short run there is also a negative relationship between coffee price booms and industrial production that is driven by an increase in local wages and document the opposite for oil price shocks.

More generally, I contribute to the literature about the Dutch Disease as pointed in Corden and Neary, (1982). Benguria et al., (2020), documents that less skill-intensive industries reduce the employment during price booms in Brazil, according to the cost effect that increases wages for low-skill employees. Their investigation poll different commodities into a index of regional exposure to commodity price shocks. This research points to the fact that the effect on wages depends on the factor intensities in the production function of the commodity. Hence the effects of commodity price shocks differ across commodities and aggregating commodities into a single index can be misleading.

Finally, my work gives new evidence about the implications of differences in factor intensity on the effect of commodity price shocks and finds similar results that Pelzl and Poelhekke (2021). These authors documents that districts in which gold mines are labor-intensive experience lower growth in employment when there is an increase in gold prices. This paper extends this line of research documenting that these differential effects are present when analyzing other commodities (coffee and oil) in the Colombian context. Additionally, I give further evidence that these effects are stronger in export-oriented industrial sectors and are not present when considering non-tradable goods (i.e. Services).

The remainder of the paper is organized as follows. Section 2, presents a theoretical model from which certain predictions and insights about the empirical strategy can be derived. Section 3 presents and describes the data. Section 4 discuss the empirical strategy while Sections 5 and 6 presents the main results and robustness checks, respectively. In section 7, I report evidence about the mechanism that can explain the main results. Finally, Section 8 concludes[4].

2 A Simple Model of Commodity Price Shocks

This section describes a multisectoral general equilibrium model that motivates the empirical model and provides predictions that can be tested.

2.1 Setup and Assumptions

Consider a small open local economy. This implies that the relative prices of tradable goods are determined by the external market and can be taken as given. There

[4]The appendix A and C present the proofs of the propositions of the theoretical section and additional tables and figures, respectively

are three distinct sectors: the primary sector, P, an industrial sector, M, and a service sector, S. The primary sector is divided into two sub-sectors: an agricultural sub-sector, A, and a natural resources sub-sector, R. It will be assumed that all sectors are tradable, except for the services sector. Within each local economy, there is perfect factor mobility. Hence, the wage is the same for each sector within that economy.

Each sector employs two factors of production: labor (L) and capital (K). However, capital is sector-specific. That is, capital employed in the primary sector cannot be employed in the industrial or service sectors, and the supply of each type of capital is fixed[5]. With this assumption, I simplify the model and focus on the mechanisms that will act through the labor market. Furthermore, by focusing on short-term shocks, it is more realistic to assume that the supply of capital, for each sector, is fixed. I will denote wages in the local economy as W, and payment to capital as r[6].

2.2 Primary Sector

As mentioned above, the primary sector consists of two sub-sectors, the agricultural sector (A) and the natural resources sector (R). The production function of each of these sectors is given by

$$X_j = A_j K_j^{\alpha_j} L_j^{1-\alpha_j} \quad j = A, R$$

Since these sectors produce tradable goods, their price is taken as given. I will assume that these sectors are competitive; hence the equilibrium (or zero profit) condition would imply that the unit cost of production must be equal to the price for each sector, (Jones, 1965). Thus, the equilibrium conditions can be stated as follows:

$$a_{AL}W + a_{AK}r = P_A \tag{1}$$
$$a_{RL}W + a_{RK}r = P_R \tag{2}$$

Where P_j denotes the price of the good j. r denotes the price of capital in the primary sector and a_{jL} and a_{jK} denote the factor requirements necessary to produce one unit j. In other words: a_{jL} and a_{jK} solve the following problem

$$\underset{a_{jL},a_{jK}}{min} \{a_{jL}W + a_{jK}r\} \quad \text{s.a} \quad A_j (a_{jK})^{\alpha_j} (a_{jL})^{1-\alpha_j} = 1 \tag{3}$$

Definition 1. *We say that sector j is labor intensive with respect to sector i if*

$$\frac{(1-\alpha_j)}{\alpha_j} > \frac{(1-\alpha_i)}{\alpha_i}$$

If the inequality is reversed, we say that sector j is capital intensive with respect to sector i.

[5] Note that that capital is mobile between the agricultural sub-sector and the natural resources sub-sector.

[6] Actually, given the specific capital assumption, there are different rates of return to capital, one for each sector. However, it will not be necessary to use a different notation for each one since only the interest rate of the primary sector will be relevant for the discussion.

In this paper, I assume that the agricultural sector is labor-intensive relative to the resource sector. Given this definition and the assumptions of the model, we have the first important result[7] :

Proposition 1. *If the agricultural sector is labor intensive with respect to the resource sector, then:*

i) $\frac{a_{AL}}{a_{AK}} > \frac{a_{RL}}{a_{RK}}$

ii) $\frac{\partial W}{\partial P_A} > 0$ *and* $\frac{\partial W}{\partial P_A \partial A_A} > 0$

iii) $\frac{\partial W}{\partial P_R} < 0$ *and* $\frac{\partial W}{\partial P_R \partial A_R} < 0$

In other words, a price shock in the agricultural sector leads to an increase in wages that is stronger in those economies with higher agricultural productivity, defined by A_A. On the contrary, price shocks in the resources sector generate a decrease in wages, and this decrease is more pronounced in economies with higher productivity in this sector (A_R). The previous theorem is an extension of the Stolper-Samuelson theorem (Jones, 1965) that shows that the effects of price shocks on wages depend on the productivity of the specific sector, in addition to the intensity with which the factors are used. In practical terms, this result tells us that, while price shocks are faced by all municipalities in a given year, the exposition to theses shocks will depend on the productivity in the municipality. Thus, economies with higher levels of coffee productivity will be more exposed to the effects of coffee price shocks, while economies with higher productivity in the oil sector are more exposed to the effects of price shocks for this good. This result will motivate the use of measures of productivity in a given sector as measures of exposure to different agricultural or resource price shocks.

2.3 Consumers

Let's assume that the local economy is populated by a set of consumers whose preferences are given by the following utility function:

$$u(D, S) = (1 - \beta_s)\ln(D) + \beta_S \ln(S)$$

Where $\beta_s \in (0, 1)$. D is an aggregator of all tradable goods consumed by agents. If it is assumed that all excess of supply is exported and excess of demand is satisfied by importing with no cost, then the functional form of this aggregator has no implications on the solution of the model because the internal demand would no determine internal production for the tradable sector (Bustos, Caprettini, & Ponticelli, 2016)[8]. The household maximizes its utility subject to the following

[7]The derivation of the results is presented in the appendix A.

[8]The functional form is important, however, for the calculation of the welfare changes after price shocks. But this is no the interest here.

budget constraint: $D + P_s S \leq W$ (where the price of the composite good has been normalized to 1)[9]. Therefore the local demand for services is given by:

$$y_S^d = \beta_S \frac{W}{P_S}$$

2.4 Services and Manufacturing

Let's assume that for manufacturing and services the technology can be describe by the following production functions:

$$y_h = A_h K_h^{\alpha_h} L_h^{1-\alpha_h} \quad h \in \{M, S\}$$

Given the assumption of fixed sector-specific capital, we have that $K_h = \bar{K}_h$. Where $\bar{K}_h$ is the sector-specific fixed supply of capital h, which we will normalize to 1. The maximization condition implies that

$$W = P_h A_h (1 - \alpha_h) L_h^{-\alpha_h} \tag{4}$$

Now, the equilibrium production in this sectors will be given by:

$$y_m = A_m \left(\frac{P_m A_m (1 - \alpha_m)}{W} \right)^{\frac{\alpha_m}{1-\alpha_m}} \tag{5}$$

$$y_s = \beta_s \left[A_s (1 - \alpha_s)^{\frac{1-\alpha_s}{\alpha_s}} \right] \tag{6}$$

From this and the results of Theorem 1, it is easy to see that the following proposition holds:

Proposition 2. *If the agricultural sector is more labor intensive than the resource sector, then*

2.1 *The heterogeneous effects of commodity price shocks on industry growth:*

i) $\frac{\partial y_M}{\partial P_A} < 0 \qquad \frac{\partial y_M}{\partial P_A \partial A_A} < 0$

ii) $\frac{\partial y_M}{\partial P_R} > 0 \qquad \frac{\partial y_M}{\partial P_R \partial A_R} > 0$

2.2 *The effects of commodity price shocks on service growth:*

iii) $\frac{\partial y_S}{\partial P_A} = 0 \qquad \frac{\partial y_S}{\partial P_A \partial A_A} = 0$

iv) $\frac{\partial y_S}{\partial P_R} = 0 \qquad \frac{\partial y_S}{\partial P_R \partial A_R} = 0$

The previous theorem states the empirical predictions that will be tested in the Colombian context. First, we have that price shocks in the labor-intensive sector

[9] I assume for simplicity that the returns of capital are given to capital owners that do not use this income for local consumption. Nevertheless, this assumption does not change the results.

affects negatively industry growth. This is because the increase in wages erodes industrial sector competitiveness. This increase in wages is greater the more productive the agricultural sector is. On the other hand, the price shock in the resource sector generates a decrease in wages and higher industrial production. On the other hand, the effect on the production of services will be zero. This is because, given the assumptions about technology and preferences, the variation in wages derived from a commodity price shocks translates into a proportional changes in the price of services. This implies that, in equilibrium, service production remains constant.

3 Data and Descriptive Statistics

3.1 Productivity and Production Structure

The model presented above highlights the fact that exposure to price shocks is determined by the municipality's productivity,A_A y A_R. Hence it is important to have a measure of technology for each commodity at the municipal level. I leverage exogenous variation in the aptitude of each municipality to produce certain agricultural goods. This measure, taken from Albertus (2019), is the logarithm of the municipality natural production capacity for low-input rain-fed coffee in kilograms. This measure is determined by geographical conditions and is independent of investments made to enhance agricultural productivity. For this reason, it is plausible that it offers exogenous variation at the municipal level of the exposure of municipalities to price shocks[10]. The measurements necessary to obtain these data were made between 1960 and 1990 and the original information is obtained from the FAO Agroecological Zones Database (Albertus, 2019) [11]. The measure of oil productivity is the average production of oil barrels for the year 1988 at the municipal level. This measure, taken from Dube and Vargas (2013), is a predetermined measure of oil production that would reflect the oil productive capacity, of Colombian municipalities. Additionally, a robustness exercise uses recent information on oil production taken from the National Mining Agency and the Ministry of mining and Energy.

I use industry and service GDP growth as independent variables. To construct these measures, I use the information available in the CEDE's *Panel Municipal* that goes from the year 2000 to 2009 (Acevedo & Bornacelly, 2014). All monetary variables were converted to 2008 pesos. Additionally, DANE population projections are used to obtain these measured in per capita terms.

[10]This measures of potential production or suitability has been used in the Colombian context. An example is Prem, Vargas, and Mejía, (2021) that uses a measure of the potential yield in coca crops as a variable of exposure to a policy announcement. In particular, these measures reflect potential opportunities for planting a given crop.

[11]This data also allows to measure the potential production at irrigated agriculture instead of rain-fed, and under medium, and high input use. Nevertheless, these measures can reflect endogenous choices of irrigation methods and input choices (Montero & Yang, 2022).

3.2 Prices

The information on coffee internal price comes from the national federation of coffee growers and is defined as the real price per 60 kg bag. Additionally, the prices of sugar, palm, tobacco, and palm, were obtained from the San Louis Federal Reserve[12]. Finally, the international price of oil is obtained from Colombian Mining Information System (SIMCO) [13]. These prices were converted to 2008 pesos.

3.3 Other Municipal Characteristics

I use information related to violence: the number of attacks, massacres, and kidnappings that occurred before the sample period[14]. These variables, interacted with annual fixed effects, allow me to control for the dynamic effects of violence on municipal production. I also used geographic variables: distance to Bogotá, to the capital of the department, altitude, and distance to the nearest market. Finally, to control for the institutional context, I use a measure of the institutional capacity in the judicial branch from Acemoglu, Fergusson, Robinson, Romero, and Vargas (2020)[15]

The table 1 presents a description of the main data. In this table, the municipalities are divided between municipalities with high and low coffee productivity (panel A). A municipality is considered highly productive if its potential coffee yield is greater than the median. On the other hand, I also classify municipalities according to whether they produced oil in 1988. Column 7 shows differences in means between different groups of municipalities.

On average, municipalities with low coffee productivity do not differ from municipalities with high productivity in terms of industrial production and services per capita. However, municipalities with high coffee productivity tend to be farther away than those with low productivity, while the differences in distance to markets and Bogotá tend to be greater. Municipalities with high coffee productivity also tend to be municipalities with more hectares cultivated with coca, are poorer (measured by the multidimensional poverty index), and have greater violence (measured in the number of kidnappings). Finally, it is interesting to note that similar dynamics are observed between oil-producing and non-oil-producing municipalities. In particular, these municipalities tend to be poorer, farther away from the department capital and Bogotá, and have higher kidnappings. Given this, it is important to control for these variables in a flexible way (see the next section).

[12]see https://fred.stlouisfed .org/

[13]See https://www1.upme.gov.co/simco/Cifras-Sectoriales/Paginas/precios -international-of-minerals.aspx

[14]This information comes from CEDE's *Panel de Violencia y Conflicto*

[15]In particular, this is a measure of complaints or denunciations that fall on the judicial branch between 1995 and 1999

4 Empirical Strategy

This section presents the empirical methodology used in the main analysis. The theoretical model provides several predictions about the behavior of the economy after a commodity price shock. One of these predictions is that these effects will be greater the more productive the municipality is to produce that commodity. Thus, motivated by this, the econometric methodology in this paper relies on estimating the following equation.

$$\begin{aligned}\Delta y_{i,r(i),t} = &\sum_{h\in H} \boldsymbol{\beta}^h (Suit^h_{i,r(i)} \times \Delta P^h_t) + \boldsymbol{\beta}^{Oil}(Oil^{88}_{i,r(i)} \times \Delta P^{Oil}_t) \\ &+ \boldsymbol{\alpha}' X_{i,r(i),t} + \mu_{i,r(i)} + \xi_t + \delta_{r(i)} t + \varepsilon_{i,r(i),t}\end{aligned} \tag{7}$$

that relates the growth rate of industrial production (or services production) of the municipality i of the region r in the period t, $\Delta y_{i,r(i),t}$, with the price shocks of the different export sectors.

In the equation (7), μ_i, ξ_t, and $\delta_{r(i)}t$ represent fixed effects of municipality, year, and a differential trend by region, respectively. $(Suit^h_{ir} \times \Delta P^h_t)$ represents the measure of price shocks of commodity $h \in H$ which is the interaction between the first difference of the logarithm of the price of h (ΔP^h_t) and the suitability of municipality i for h. $(Oil^{88}_{i,r(i)} \times \Delta P^{Oil}_t)$ is the measure of oil price shocks and is the result of the multiplication of the first difference in the log of oil price with the average production of barrels in 1988, as a measure of the productive capacity for oil.

Finally, $X_{i,r(i),t}$ is a vector of controls interacted with a full set of time fixed effects. Such controls are divided into two types: i) geographic controls, which are variables that measure the distance from the municipalities to nearby markets, the capital of the department, and altitude; ii) the baseline controls are predetermined measures of attacks and kidnappings of illegal groups, as well as the effectiveness of justice and initial poverty measures. All of this is done to control for the dynamic effects of these initial conditions. The results are robust, however, to the inclusion or exclusion of these controls.

Now, there are two definitions of the set H. In the first, $H = \{$Coffee$\}$, while in the second $H = \{$Coffee, Banana, Tobacco, Palm, Sugar$\}$. This second definition of H control for the possible correlation between the attitude to produce coffee, specifically, and the attitude of the municipality toward other agricultural goods. If the specification does not control for price shocks in other agricultural goods, it is plausible that the estimates are biased by the effect of agricultural expansion in municipalities with high general agricultural productivity.

4.1 Identification

First, given that Colombia is a major coffee producer, the price of coffee may depend to some extent on national circumstances, which in turn may be correlated with industrial or service production. For example, suppose that there is an increase in industrial productivity in coffee-producing municipalities (caused by investments in infrastructure or by the adoption of new technologies). This will generate an increase in wages, which makes coffee production less profitable, leading to a decrease in the production and export of Colombian coffee. This would increase the international coffee price. Therefore, a positive correlation would emerge between the coffee international price and growth in industrial production (for coffee-producing municipalities). Additionally, part of the domestic coffee price is determined by considering a premium for Colombian coffee. Therefore, there may be unobservable factors that are associated with higher investment in coffee quality and higher investment in other industries (e.g., a better investment environment due to less civil violence).

The identification strategy relies on leveraging plausibly exogenous variation exports from other countries. Namely: Brazil, Indonesia, and Vietnam. The reasons behind this are various. First, several cases have been documented in which climatic or other shocks specific this countries have affected international coffee price and with it, the internal coffee price (Miller and Urdinola, 2010; Carrillo, 2020; Dube and Vargas, 2013). Second, the percentage variation in coffee's internal price is strongly associated with the variation in these countries' exports, which make up a large part of the international coffee market. In particular, the F statistic in the main specification is approximately 38, as shown by tables 2 and 3. Furthermore, there is evidence that variations in the export levels of these producers are exogenous to Colombian production and export trends[16]. Finally, it is worth noting that this methodology has been used in the Colombian context by Albertus, (2019) who studies the effect of coffee price shocks on the allocation of agricultural land.

With this, the first stage is:

$$\begin{aligned}(Suit^{coff}_{i,r(i)} \times \Delta P^{coff}_t) = &\sum_{h \neq coff} \boldsymbol{\beta}^h (Suit^h_{i,r(i)} \times \Delta P^h_t) + \boldsymbol{\gamma}(Suit^{coff}_{i,r(i)} \times \Delta Export_t) \\ &+ \boldsymbol{\beta}^{Oil}(Oil^{88}_{i,r(i)} \times \Delta P^{Oil}_t) + \boldsymbol{\alpha}' X_{i,r(i),t} \\ &+ \mu_i + \xi_t + \delta_{r(i)} t + \varepsilon_{i,r(i),t}\end{aligned} \tag{8}$$

Where the super index $coff$ refers to coffee and $Export_t$ is the sum of the quantity exported by Brazil, Indonesia, and Vietnam. Note that we are only controlling for possible endogeneity in the growth rate of the coffee price using the growth rate of exports from other countries. Thus, the possible endogeneity associated with our price shock measure for coffee $(Suit^{coff}_{i,r(i)} \times \Delta P^{coff}_t)$ is eliminated with plausibly exogenous variation generated by $(Suit^{coff}_{i,r(i)} \times Export_t)$.

[16] The section 5.2 present several exercises that show that *i)* Colombian coffee exports remained relatively constant during the sample period, *ii)* if the instrument is the variation in coffee exports of other less prominent coffee producers (which perhaps do respond strategically to variations in Colombian production, but due to their weight in the international market could not influence the price) the results are very different.

5 Results

This section present the main results (section 5.1) and discuss possible threats to identification (section 5.2). The next section presents an analysis of the robustness of he results to different specifications.

5.1 Main results

Table 2 presents the results of estimating equation (7) via 2SLS using the first difference in the log of industrial GDP per capita as the independent variable[17]. I estimate two different models The first, columns (1) and (2), do not control for other agricultural price shocks ($H = \{\text{Coffee}\}$). The second model, columns (3) and (4), defines $H = \{$ Coffee, Banana, Tobacco, Palm, Sugar $\}$; controlling for other commodity price shocks. If the measure of suitability to produce coffee is correlated with measures of suitability for other agricultural goods and the coffee price shocks are correlated with the price shocks of other goods, the estimated effect can be biased. The comparison between columns 2 and 4 shows that, after controlling for other agricultural price shocks, the effect of coffee price shocks is reduced but still economically and statistically significant.

Panel A presents the result of estimating both models, first by OLS and by the instrumental variables methodology. The first thing to highlight is the fact that the effect of coffee price shocks changes sign and significance when the instrumental variables method is used. A possible explanation behind this could be related to the fact that the coffee price is determined, in part, by the premium paid for Colombian coffee. As already mentioned, this premium could be correlated with an improvement in coffee production, in turn, facilitated by a better environment for technological development. In other hand there can be differential trends in coffee exports and industrial growth for coffee producer municipalities. Another possible explanation is related to the fact that the price paid to coffee growers varies at the national level due to storage, marketing, and transportation costs. In this sense, the average domestic price is a noisy measure (that is, it contains a measurement error) of the price paid to coffee growers.

It should be noted that the estimated effect of oil price shocks on industry growth is positive and significant. This supports the previously exposed theory that price shocks in capital-intensive sectors could generate positive effects on industrial production. The row, Coffee Effect (Oil Effect) shows the effect of an increase in the rate of growth of the price of coffee (oil) by one standard deviation for the municipality with a capacity to produce coffee equal to the median (oil production in 1988 equal to the median, conditional on having a positive oil production). It can be seen that in the preferred specification (column 4) this effect is equal to -0.28 standard deviations. In the case of oil, the estimated effect is 0.007 standard deviations. For completeness tables A.1 and A.2 show the full results.

[17]The results are identical when the growth rate calculated in the usual way is used.

The table 3 shows the result of estimating the equation (7) with GDP growth in services per capita as the independent variable. It is reassuring that the parameters are not significant in this case, and smaller (in absolute value) that those estimated for industry growth. Therefore, this result points out that the services sector could respond in some extend to changes in wages through changes in prices.

5.2 Identification Threats

As I show before, the instrument is strong[18]. Additionally, in the table 2 Panel B shows that that the estimator of γ from the equation (8) is negative and significant. That is, a growth in coffee exports by the leading countries is strongly associated with a decrease in the coffee domestic price . In addition, in this section, I present suggestive evidence that the exclusion restriction hold, according to which the exports of the other large producers do not affect or correlate with variables that affect the industrial production or services in Colombian municipalities, conditional on the controls.

On the one hand, the exclusion assumption can be violated if the exports of other large producers respond to changes in national exports and at the same time, these changes are correlated with variables that affect industrial production at the local level (Dube & Vargas, 2013). For example, a differential increase in civil conflict in coffee municipalities could affect industrial, services, and coffee production. As Colombia is a large producer of coffee, this would generate pressure on the coffee international price that could modify the export decisions of these countries. To analyze this possible threat, figure 1 shows the evolution of coffee exports from Brazil, Vietnam, Indonesia, and Colombia[19]. It shows how Colombian coffee exports have remained almost constant (around 10 million 60-kilogram bags) during most of the sample period, while the production of the other countries seems to show greater fluctuation. This suggests that fluctuations in production in other countries are not likely to be due to responses in domestic production patterns.

On the other hand, if the exports of the other countries respond to the dynamics of domestic production in Colombia, it is likely that other countries with a lower market share will also do so, but their export decisions would not have an effect on the international coffee price. Thus, if the result reported in the tables 2 and 3 is due to a dynamic response to fluctuations in Colombian exports, then when instrumenting the domestic price with the production of other countries with a low market share similar results would be obtained. Hence, as a placebo test, I estimate the equation 7 using the exports of coffee producers with a low market share[20]. Table A.6 shows the result of performing this exercise using the logarithm of the sum of the expectations of Mexico, Ivory Coast, and Nicaragua (columns 1 and 2) and these countries plus Papua New Guinea, El Salvador, and Costa Rica. These

[18] The F statistic is almost 37.

[19] This figure is similar to figure 2 of Dube and Vargas (2013)

[20] Note that this exercise makes sense as it does not use marginal countries but countries whose production does not seem to affect the international price.

countries occupy positions from 9 to 15 with respect to world coffee production[21]. It is interesting to note that the production of these countries is positively correlated with the domestic price. On the other hand, the estimation results completely change and resemble the OLS results[22]. For the reasons already mentioned, this is taken as evidence that the instrument seems to generate exogenous variation in the domestic price through increases in the supply of coffee, and not in response to variations in Colombian production.

6 Robustness

This section presents several robustness exercises. It shows that the results are robust to different set of controls, other agricultural and oil productivity measures, and to different specifications of the instrument. Lastly, I show that the results do not change when eliminating an oil-producing municipality at a time.

6.1 Different set of controls

I start by analyzing whether the results obtained change when all controls are excluded or only a subset of them are included. The table A.3 shows the result of estimating the equation 7 by IV without controls (column 1), only with differential trends by region (column 2), with this trends and initial controls (column 3). Additionally, column 4 includes all the previous controls and adds a set of trends by province. The inclusion of this set of trends makes it possible to capture possible local divergences due to the characteristics of these provinces and can capture differential trends between different sub-regions in the country. It can be seen that the exclusion of the different groups of controls does not affect the sign of the estimates. The effect ranges from a 0.2 to a 0.3 standard deviation reduction in the industrial GDP growth rate (from a one standard deviation change in the coffee price growth rate). There is variation in the F statistic. However, even in the most complete specification (column 4), this instrument remains strong.

6.2 Other measures of agricultural productivity

A possible problem with the proposed methodology is that it uses agro-climatic variation in the potential yield of various crops as a source of variation between municipalities. It is possible that these measures do not reflect the exposure to crop price shocks due to structural characteristics (for example, lack of communication infrastructure) that do not allow the production of a certain agricultural

[21] I rank these countries according to the data obtained from the International Coffee Organization https://www.ico.org/trade_statistics.asp

[22] Nevertheless, this is not due to a weak instrument problem, since the instrument is still strongly correlated with coffee internal price: The F statistics in the preferred specification is close to 28.

good, even when the municipality can otherwise have potentially high yields. It is worth noting that controlling for municipal fixed effects takes into account, in part, these possible structural characteristics (Albertus, 2019).

Using the observed yield (production per cultivated hectare) as a measure of productivity, however, can create several endogeneity problems. First, by definition, this indicator can only be observed if cultivated hectares are greater than zero. This would create selection problems since the decision to plant coffee possibly depends on factors associated with industrial production growth. For example, suppose we have two municipalities with the same level of potential yield, but one produces coffee (and the other doesn't) because of lower growth in human capital accumulation and, hence, in opportunities for industrialization. In this case, coffee-producing municipalities have a different trend in industry growth.

Given this, the main specification uses potential rather than observed yield as our exposure measure. However, it is valuable to compare the main results with those obtained with observed yields. Thus, the table A.5 shows the result of estimating the equation 7 by replacing ($Suit^{h}_{it}$) with the yield (production per average hectare) observed during the analysis period[23] [24]. The effect of coffee shocks on the price of coffee becomes greater, in absolute terms. However, the qualitative results do not change.

6.3 Alternative definitions of the instrument

The main result is based on an instrument that is constructed as the sum of the level of exports of three other large producers. In this subsection, I show that the results hold when other definitions of the instrument are used. In particular, when the production of 6 and 9 other producers (instead of the three big producers) is used to construct the instrument. This is a valuable exercise as it makes it possible to show whether the results are due to a special behavior of the production of Brazil, Indonesia, and Vietnam. In this sense, the table A.6 shows the result of estimating the equation 7 through instrumental variables using these definitions of the instrument. The instrument loses power, but the results are similar to those in tables 2 and 3: the coefficient that measures the effect of price shocks on coffee remains negative and significant, while the coefficient associated with the shock on oil remains unchanged.

6.4 Alternative Oil Production Measures

The results are also robust changes in the measure of oil production. Recall that the main analysis uses oil production in 1988 as a measure of the municipalities'

[23] The data was taken from the CEDE's *Panel de Agricultura y Tierra*

[24] Observed yield is defined as production per hectare. If the production is zero, yield is coded as zero. In particular, I use the logarithm of observed yield plus 0.01 to deal with the zeros in this variable.

exposure to oil price shocks. This exposure measure, given that it is predetermined, can plausibly be exogenous: although the fact that it is predetermined does not imply that it does not correlate with the error term, it does imply that, if there is an omitted variable, it should be correlated with oil production in 1988 and with factors determining the growth of industrial production in the period of analysis (2000-2009). Many of these variables (such as demographic and historical factors) are being captured by the municipality fixed effects. Additionally, as already shown, introducing various controls and modifying the specifications does not affect, in general, the estimated value of β^{Oil}, in the equation 7.

Despite this, oil production measures may not reflect the exposure to oil price shocks, due to changes in the production structure of this sector. For this reason, analyzing whether the results hold when using another measure of oil production seems pertinent. For this, I use the oil production in 2010, at the municipal level, measured as the average number of barrels produced per day[25].

The result of this exercise is presented in table A.8. In columns 1 and 2, the measure of oil production in each municipality is measured in 2010. Columns 3 and 4, show the results from using a measure of $Oil_{i,r(i)}$ that is equal to the oil production in 1988 if, in 2010, the municipality reports positive oil production, and zero otherwise. This last measure would reflect the historical production, but only in those municipalities that in 2010, are still producing oil. In general, the qualitative results are maintained. In particular, there is evidence of a positive effect of price shocks in the oil sector on industrial production and a small and insignificant effect on the production of services. However, the estimated effect when the measure of production in 2010 is used is greater (0.03 standard deviations). This is likely due to endogeneity issues: oil production in the year 2010 may be correlated with other municipal characteristics that positively affect industrial production.

6.5 Other robustness checks

Finally, because there are a relatively small number of municipalities producing oil in 1988, the results may be sensible to specific values taken by this variable. To determine the importance of this potential problem the figures A.1 and A.2 shown the coefficients form estimating the equation (7) via 2SLS with the industry and service GDP growth as the independent variable leaving one oil-producing municipality at a time. The results show that for the effect of a coffee shock there are no important differences between specifications. For the oil effect estimate, the exclusion of a municipality, Arauca (that has an unusually large oil production), has an important effect: the coefficient is twice as large but more noisily estimated in the case of industry GDP growth. Besides this, the qualitative results remain unchanged. In other hand, the figure A.3 shows that there are no systematic differences in the evolution of the growth rates between municipalities included and no included in

[25] It was not possible to extract information before this period. Production per field and information concerning the municipality in which the specific field is located is taken from the National Hydrocarbons. See https://www.minenergia.gov.co/web/ingles/statistics2.

the main sample[26].

7 Mechanisms

The results presented in section 5.1 are in line with the model's predictions in section 2: I document a negative effect of coffee price shocks and a positive, but modest, effect of oil price shocks on industrial growth. Additionally, I find no effect on service production growth. In the theoretical section I argue that these effects are due to differential effects on wage growth that affects industry and service production in different ways. However, these findings can be driven by other factors.

A possible channel through which commodity price shocks can affect economic and social outcomes is income and local demand: price booms generally imply an increase in wages or profits and, hence, in local demand. Nevertheless the evidence provided so far points that this is not driving the results. First, if this mechanism were important, it can be expected a positive and sizable effect of commodity price shocks on services production growth. Table 3 shows that this is no the case. In particular, it shows that the estimated effect of oil price shocks on service growth (the estimate of $\boldsymbol{\beta}^{Oil}$, in equation (7)) is smaller that these for industry growth. Second, this hypothesis can no explain the negative effect of coffee price shocks on industrial production growth.

Additionally, in this section a I present further evidence about the mechanism in a exercise based on the fact that, if commodity price shocks affects industrial production through a increase in wages that reduces competitiveness, then these effects will be stronger in industrial sub-sectors that are export-oriented. This is because these industries take the international price as given, independently of the national cost of labor. In particular, if an industry is more export-oriented, when wages increase, it has less capacity to adjust the prices they charge, at least in the short run, resulting in a bigger reduction in employment and growth. This prediction will be tested in this section based on the following equation:

$$\begin{aligned}\Delta y_{i,r(i),t} =& \boldsymbol{\beta}^{coff}(Suit^{coff}_{i,r(i)} \times \Delta P^{coff}_t) + \boldsymbol{\beta}^{Oil}(Oil^{88}_{i,r(i)} \times \Delta P^{Oil}_t) \\ &+ \boldsymbol{\beta}^{Oil,Exp}(Exp_{i,r(i)} \times Oil^{88}_{i,r(i)} \times \Delta P^{Oil}_t) + \boldsymbol{\beta}^{Coff,Exp}(Exp_{i,r(i)} \times Suit^{coff}_{i,r(i)} \times \Delta P^{coff}_t) \\ &+ \boldsymbol{\alpha}' X_{i,r(i),t} + \mu_{i,r(i)} + \xi_t + \delta_{r(i)} t + \varepsilon_{i,r(i),t}\end{aligned} \tag{9}$$

where $Exp_{i,r(i)}$ is a dummy variable that indicates if a municipality is classified as export-oriented. To construct this variable I classify industrial sub-sectors (at the two digits CIIU rev 3 level) according to their export behavior based on trade statistics. Then, I measure the share of employment in each of these industries using

[26] I exclude some department capitals as in Dube and Vargas (2013) and there were other municipalities with no information for some controls.

the IPUMS sample of the 2005 Colombian census (Ruggles, King, Levison, McCaa, & Sobek, 2003)[27]. Finally I classify IPUMS municipalities as export-oriented if the employment share in export-oriented sub sectors is bigger that the median across IPUMS municipalities[28]. Hence, the parameter $\beta^{Coff,Exp}$ will indicate the differential impact of coffee price shocks between export-oriented municipalities and the rest of the municipalities. The theory developed so far predicts this coefficient will be negative because the industries in this kind of municipalities are more affected by the increases in wages. Furthermore, $\beta^{Oil,Exp}$ will indicate this differential effect for oil price shocks. Again, the model predicts that the reduction of wages, caused by a positive oil price shock, will be more beneficial for municipalities that rely more on export-oriented industries that gain competitiveness in the international markets. Hence the model states that $\beta^{Oil,Exp}$ will be positive. The set of control variables $X_{i,r(i),t}$ includes the other agricultural price shocks and their interaction with the variable $\text{Exp}_{i,r(i)}$ [29].

I estimate equation (9) using as an instrument for the internal coffee price, the coffee exports of Brazil, Indonesia, and Vietnam in the second and third interaction. The results from this exercise are reported in table 4. The first column reproduces the results from column 4 of table 5. Before the aggregation at the IPUMS municipality level, municipalities not used in the main analysis were dropped to make the estimations comparable. Due to the fact that small neighbor municipalities are aggregated in larger IPUMS municipalities, these results show that the conclusions are not driven due to spatial dynamics between groups of small neighbor municipalities.

Row two of column 2, in another hand, shows that the negative effect of coffee price shocks on industrial growth is more pronounced in municipalities with a larger share of export-oriented industries. For a municipality with an above the median employment share in export-oriented industries, the negative effect of coffee price shocks is almost twice that of the rest of the municipalities. This result is in line with the model predictions because the increase in wages caused by a coffee price shock reduces the competitiveness of export-oriented industries. In fact, β^{coff} in equation 4 is no longer statistically significant but $\beta^{Coff,Exp}$ is.

For the Oil sector, the results are, as well, in line with the theoretical model and the proposed mechanism. The fourth row of column 2 in table 4 shows that the effect of oil price shocks on industrial growth is bigger in more export-oriented municipalities. Again the estimated effect is bigger than the effect for the other municipalities, and it is statistically significant. This implies that the results found in section 2 are driven by municipalities with a large share of export-oriented industries.

Finally, columns 3 and 4 of table 4 show the results of estimating equation (9)

[27] There is no information of industry employment at the sub-industrial sector in the 1993 Colombian census.

[28] This set of municipalities differs from the administrative division of municipalities because IPUMS groups small neighbor municipalities (less than 20 thousand inhabitants), due to confidentiality restrictions, in one unity. In appendix B I give further details of the construction of $Exp_{i,r(i)}$.

[29] Note that time fixed effects control for exchange rate fluctuations.

with the growth rate of service production as the dependent variable. Here it is no expected differential effects between export-oriented municipalities and the others municipalities because this classification is done according to trade information of industrial sectors. Hence this exercise can be seen as a placebo test that can give evidence that the results in the other columns are not driven by differential trends in municipalities with export oriented industries. For example, if there are differential trends in productivity growth between municipalities with different values of $Exp_{i,r(i)}$. In this case the results show a negligible differential effect for between each type of municipality.

8 Conclusions

This research addresses the differential effects of commodity price shocks on industrial and service production growth. I find that increases in coffee prices generate lower growth in industrial production and that this effect is stronger in municipalities with a high share of employment in export-oriented industries. In contrast, I find that oil price shocks generate an increase in industrial production, especially in export-oriented industries. I find smaller and not statistically significant effects on the services production growth. I argue that this is due to the capacity of service producers to cope with the effects of wage variations through variations in the price of these services. These results imply that, in order to analyze the effect of commodity price shocks on local economies, the technological characteristics of the commodity production function must be taken into account (in particular, the intensity of the use of capital and labor), and the export-orientation of the different industries in the local economy)

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Table 1: Descriptive Statistics

	Todos		High Suitability		Low Suitability		Differences
	Average	SD	Average	SD	Average	SD	(3)-(5)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
***Panel A:* Descriptive Statistics by Coffee Suitability**							
Industrial GDP per head	0.029	(0.057)	0.036	(0.076)	0.022	(0.023)	0.015
Services GDP per head	0.035	(0.036)	0.036	(0.048)	0.034	(0.017)	0.002
GDP per head	0.073	(0.057)	0.079	(0.072)	0.067	(0.035)	0.012
Coca hectares in 1994	0.072	(0.584)	0.132	(0.803)	0.006	(0.066)	0.126
Urban Population	0.012	(0.024)	0.015	(0.027)	0.009	(0.020)	0.006
Altitude	12.088	(9.098)	7.220	(6.643)	17.344	(8.443)	−10.124
Distance to department's capital	79.528	(55.766)	83.862	(59.788)	74.847	(50.660)	9.015
Distance to closest market	127.642	(111.862)	147.596	(135.989)	127.642	(111.862)	41.502***
Distance to Bogotá	308.485	(190.471)	332.693	(211.749)	282.344	(160.398)	0.126***
MPI	68.705	(15.588)	70.531	(15.158)	66.740	(15.820)	3.791***
Underweight Index	0.060	(0.025)	0.055	(0.022)	0.065	(0.026)	−0.010
Kidnappings	2.872	(5.098)	3.305	(5.639)	2.403	(4.393)	0.902***
Area (Millions of Hectares)	0.100	(0.332)	0.156	(0.448)	0.040	(0.077)	0.116***
Number of Municipalities	990		514		476		
	Todos		Oil Producers		Non Oil Producers		Differences
	Average	SD	Average	SD	Average	SD	(3)-(5)
***Panel B:* Descriptive Statistics by Oil Production History**							
Industrial GDP per head	0.029	(0.057)	0.049	(0.072)	0.028	(0.056)	0.021
Services GDP per head	0.035	(0.036)	0.033	(0.015)	0.035	(0.037)	−0.003
GDP per head	0.073	(0.057)	0.105	(0.088)	0.072	(0.055)	0.033
Coca hectares in 1994	0.072	(0.584)	0.374	(1.397)	0.059	(0.520)	0.314
Urban Population	0.012	(0.024)	0.022	(0.032)	0.011	(0.024)	0.011
Altitude	12.088	(9.098)	4.805	(5.931)	12.386	(9.081)	−7.581
Distance to department's capital	79.528	(55.766)	101.961	(73.278)	78.608	(54.738)	23.353***
Distance to closest market	127.642	(111.862)	144.039	(90.515)	127.642	111.862	17.070***
Distance to Bogotá	308.485	(190.471)	330.521	(133.207)	307.581	(192.406)	22.940
MPI	68.705	(15.588)	70.342	(11.601)	68.637	(15.731)	3.791***
Underweight Index	0.060	(0.025)	0.048	(0.016)	0.060	(0.025)	−0.013
Kidnappings	2.872	(5.098)	8.564	(10.932)	2.638	(4.558)	5.926***
Area (Millions of Hectares)	0.100	(0.332)	0.186	(0.201)	0.097	(0.336)	0.089***
Number of Municipalities	990		39		951		

Descriptive statistics of the main variables of the analysis. Industrial, services and total GDP per capita is in millions of 2008 pesos. Hectares of coca are measured in thousands of hectares. The population measures are in millions. Height is measured in hundreds of meters above sea level. All distance variables are measured in Kilometers. The low birth weight index is measured as the number of births with low weight over the number of total births and is constructed with information from the CEDE Municipal Panel. The area refers to the area of the municipality. High Suitability refers to municipalities with coffee suitability bigger than the cross municipality median. Low suitability refers to the rest of the municipalities. Oil producers are municipalities with positive oil production in 1988. *** p<0.01, ** p<0.05, * p<0.1

Table 2: Effect of Commodity Price Shocks on Industrial Production

	Model 1		Model 2	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A. OLS y IV				
dep Var: Growth rate Industrial GDP Per Capita				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	0.0035	-0.0586^{**}	0.0053	-0.0513^{**}
	(0.0083)	(0.0249)	(0.0089)	(0.0249)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.1046^{***}	0.1053^{***}	0.1134^{***}	0.1140^{***}
	(0.0241)	(0.0244)	(0.0224)	(0.0227)
Coffee Effect	0.019	-0.328	0.030	-0.287
Oil Effect	0.006	0.006	0.007	0.007
F-Stat	–	37.66	–	36.69
R^2	0.276	0.259	0.285	0.272
	Model 1		Model 2	
Panel B. First stage				
dep Var: log(Coffe Suit) $\times \Delta log$(Coffee Price)				
log(Coffe Suit) $\times \Delta log$(Export: Top 3)	-0.5966^{***}		-0.6440^{***}	
	(0.1137)		(0.1223)	
Obs	8433		8433	
N Mun	937		937	
Municipal and Year FE	✓		✓	
Region Trends	✓		✓	
Baseline Controls	✓		✓	
Geographic Controls	✓		✓	

Notes: Results from estimating the equation (7) via MCO and 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in (Dube & Vargas, 2013) and several municipalities with no information about coffee suitability. The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table 3: Effect of Commodity Price Shocks on Service Production

	Model 1		Model 2	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A. OLS y IV				
dep Var: Growth rate Service GDP Per Capita				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	0.0017	0.0012	0.0024	0.0027
	(0.0025)	(0.0071)	(0.0028)	(0.0069)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.0076	0.0076	0.0066	0.0066
	(0.0048)	(0.0048)	(0.0049)	(0.0049)
Coffee Effect	0.020	0.014	0.029	0.032
Oil Effect	0.001	0.001	0.001	0.001
F-Stat	–	37.66	–	36.69
R^2	0.197	0.197	0.199	0.199
Obs	8433		8433	
N Mun	937		937	
Municipal and Year FE	✓		✓	
Region Trends	✓		✓	
Baseline Controls	✓		✓	
Geographic Controls	✓		✓	

Notes: Results from estimating the equation (7) via MCO and 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in (Dube & Vargas, 2013) and several municipalities with no information about coffee suitability. The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

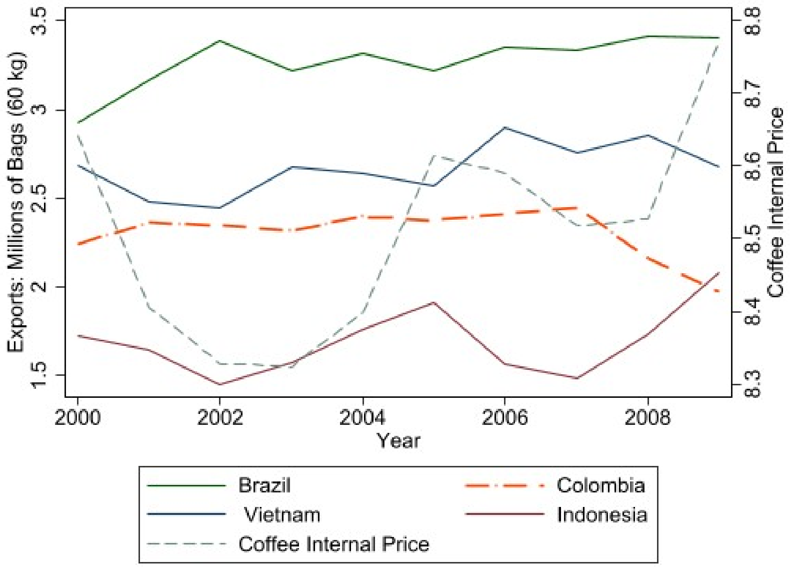


Figure 1: Evolution of Coffee Exports: 4 Large Producers

Notes: evolution of exports from Brazil, Indonesia, Colombia, Vietnam and of coffee internal price.

Table 4: Mechanism: Differential Effect of Commodity Price Shocks on Industry and Services

	Growth rate Industrial GDP Per Capita		Growth rate Services GDP Per Capita	
	(1)	(2)	(3)	(4)
Shock Coffee	−0.0608**	−0.0446	0.0098	0.0107
	(0.0301)	(0.0304)	(0.0079)	(0.0078)
Shock Coffee × Export Oriented		−0.0302**		−0.0014
		(0.0122)		(0.0034)
Shock Oil	0.2224**	0.1011	−0.0120	−0.0250
	(0.1101)	(0.1074)	(0.0328)	(0.0331)
Shock Oil × Export Oriented		0.7754***		0.0892
		(0.2566)		(0.0639)
Coffee Effect	-0.411	-0.296	0.121	0.128
Coffee Effect Export Oriented		-0.205		-0.017
Oil Effect	0.019	0.016	-0.002	-0.007
Oil Effect Export Oriented		0.031		0.007
F-Stat	2829.63	1442.06	2829.63	1442.06
R^2	0.275	0.272	0.247	0.247
Obs	3060	3060	3060	3060
IPUMS municiplaity and Year-State FE	✓	✓	✓	✓
Region Trends	✓	✓	✓	✓
Baseline Controls	✓	✓	✓	✓
Geographic Controls	✓	✓	✓	✓

Notes: Results from estimating the equation (9) via 2SLS from an Balance panel. The unit of observation is the IPUMS Municipality-Year. The period is 2000-2009. Standard errors are clustered at theIPUMS Municipality level. The baseline controls refer to the predetermined variables that interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

A Proofs

Proof of proposition 1 First, it'll be proved the i part. This is easily derived by considering the definition of a_{jL} and a_{jK}. Specifically, if the problem in 3 is solved, it will be found that:

$$\begin{aligned}\frac{a_{jL}}{a_{jK}} &= \frac{\left(\frac{r}{W}\right)^{\alpha_j}\left(\frac{1-\alpha_j}{\alpha_j}\right)^{\alpha_j}\frac{1}{A_j}}{\left(\frac{W}{r}\right)^{1-\alpha_j}\left(\frac{\alpha_j}{1-\alpha_j}\right)^{1-\alpha_j}\frac{1}{A_j}} \\ &= \left(\frac{r}{W}\right)\left(\frac{1-\alpha_j}{\alpha_j}\right)\end{aligned}$$

From which, it is easy to see that i holds. The rest of the theorem follows from the fact that, by the envelope theorem, the derivative of the unit cost of producing good j with respect to the price of good i, p_i, will be:

$$\begin{aligned}\frac{\partial C_j(p_i)}{\partial p_i} &= \frac{\partial W}{\partial p_i}a_{jL} + \frac{\partial a_{jL}}{\partial p_i}W + \frac{\partial r}{\partial p_i}a_{jK} + \frac{\partial a_{jK}}{\partial p_i}r - \lambda\left[\frac{\partial F_j(a_{jK}, a_{jL})}{\partial p_i}\right] \\ &= \frac{\partial W}{\partial p_i}a_{jL} + \frac{\partial a_{jL}}{\partial p_i}W + \frac{\partial r}{\partial p_i}a_{jK} + \frac{\partial a_{jK}}{\partial p_i}r - \left[\lambda\frac{\partial F_j(a_{jK}, a_{jL})}{\partial a_{jL}}\frac{\partial a_{jL}}{\partial p_j} + \lambda\frac{\partial F_j(a_{jK}, a_{jL})}{\partial a_{jK}}\frac{\partial a_{jK}}{\partial p_j}\right] \\ &= \frac{\partial W}{\partial p_i}a_{jL} + \frac{\partial a_{jL}}{\partial p_i}W + \frac{\partial r}{\partial p_i}a_{jK} + \frac{\partial a_{jK}}{\partial p_i}r - \left[W\frac{\partial a_{jL}}{\partial p_i} + r\frac{\partial a_{jK}}{\partial p_i}\right] \\ &= \frac{\partial W}{\partial p_i}a_{jL} + \frac{\partial r}{\partial p_i}a_{jK}\end{aligned}$$

Deriving the equations (1) and (2) with respect to p_R, for example, results in the following system of equations:

$$\begin{aligned}\frac{\partial W}{\partial p_R}a_{RL} + \frac{\partial r}{\partial p_R}a_{RK} = 1 \\ \frac{\partial W}{\partial p_R}a_{AL} + \frac{\partial r}{\partial p_R}a_{AK} = 0\end{aligned}$$

Solving this system of equations, we get

$$\frac{\partial W}{\partial p_R} = \frac{-a_{AK}}{a_{AL}a_{RK} - a_{RL}a_{AK}} < 0$$

A similar procedure, leads to:

$$\frac{\partial W}{\partial p_A} = \frac{-a_{RK}}{a_{RL}a_{AK} - a_{AL}a_{RK}} > 0$$

Finally, I will probe that $\frac{\partial W}{\partial p_R A_R} < 0$ and that $\frac{\partial W}{\partial p_A A_A} > 0$. For this, lets introduce the definitions of a_{jL} and a_{jK} inside the previous equations to obtain

$$\begin{aligned}\frac{\partial W}{\partial p_A} &= \frac{-a_{RK}}{a_{RL}a_{AK} - a_{AL}a_{RK}} \\ &= \left(\frac{W}{r}\right)^{\alpha_A} A_A \left[\left(\frac{1-\alpha_A}{\alpha_A}\right)^{\alpha_A} - \frac{1-\alpha_R}{\alpha_R}\left(\frac{\alpha_A}{1-\alpha_A}\right)^{1-\alpha_A}\right]^{-1}\end{aligned}$$

So $\frac{\partial W}{\partial p_A A_A} > 0$ is greater than zero if

$$\frac{1-\alpha_A}{\alpha_A} > \frac{1-\alpha_R}{\alpha_R}$$

i.e if agriculture is more labor intensive than the resource sector. Additionally

$$\frac{\partial W}{\partial p_R} = \left(\frac{W}{r}\right)^{\alpha_R} A_R \left[\left(\frac{1-\alpha_R}{\alpha_R}\right)^{\alpha_R} - \frac{1-\alpha_A}{\alpha_A}\left(\frac{\alpha_R}{1-\alpha_R}\right)^{1-\alpha_R}\right]^{-1}$$

So $\frac{\partial W}{\partial p_R A_R} < 0$.

Proof of proposition 2 It is easy to prove Theorem 2 from the derivation of the equilibrium output of the manufacturing and service sectors. From the equation (4), it can be seen that

$$L_h = \left[\frac{P_h A_h (1-\alpha_h)}{W}\right]^{\frac{1}{\alpha_h}}$$

Plugging this into the production function (and taking into account that the sector-specific capital will be normalized to 1) we arrive at the equation (5). From this equation, it can be easily seen that the derivative of y_m with respect to P_A and P_R have the opposite signs to the sign of the derivative of W with respect to these variables. On the other hand, we have that the balance of supply and demand in the services sector implies that:

$$y_S = A_S\left(\frac{P_S A_S (1-\alpha_S)}{W}\right)^{\frac{\alpha_S}{1-\alpha_S}} = \beta_S \frac{W}{P_S}$$

From which it follows that:

$$\frac{W}{P_S} = \left[A_s(1-\alpha_s)^{\frac{1-\alpha_s}{\alpha_s}}\right]$$

Plugging this into the service demand function we arrive at the equation 6. From these equations, it is easy to see that proposition 2 holds.

B Classification of Export Oriented Municipalities

I define $\text{Exp}_{i,r(i)}$ as

$$\text{Exp}_{i,r(i)} = 1[\omega^{exp}_{i,r(i)} \geq \omega^{exp}]$$

where $1[.]$ is a indicator function that is equal to one if the expression in brackets is true. $\omega^{exp}_{i,r(i)}$ is the share of employment in export oriented industries of municipality i in region $r(i)$, and ω^{exp} is the median across municipalities of this measure. In other words, $\text{Exp}_{i,r(i)}$ is an indicator of a municipality having a share of employment in export oriented industries above the median across municipalities. I use IPUMS sample of the 2005 Colombian census to determine the employment in each two-digit CIIU REV3 sector in each IPUMS municipality[30]. This set of municipalities differs from the administrative division of municipalities because IPUMS groups small neighbor municipalities (less than 20 thousand inhabitants), due to confidentiality restrictions, in one unity. Hence the number of unities is less in the IPUMS municipality sample[31].

Now, It only remains to describe how to classify a given industry as export oriented. To do this I use trade statistics at the industry level to determine a measure of the importance of exports in a given industrial sector[32]. In particular, this measure is the ratio between exports and the sum of exports and imports,

$$\pi_s = \frac{\text{Exports}_s}{\text{Imports}_s + \text{Exports}_s}$$

where Exports_s and Imports_s are the mean real exports and imports in industry s between the years 1995 and 1999[33]. Then industries are classified as export-oriented if π_s is bigger than the median across industries[34]. Table A.9 presents the result of this classification exercise.

[30] There are no available information of industry employment at the in he 1993 Colombian census.

[31] As is reported in table (4) the results of estimating our main equation (7) does not change using the IPUMS municipality level data.

[32] In the data, the sectors are defined according to the two-digit CIIU REV-3 classification.

[33] The data comes from the International Trade statistics of the Departamento Nacional de Planeación. I drop industries where $\text{Imports}_s = 0$, or, in other words, where $\pi_s = 1$.

[34] In the data this median is 0.4988 and the mean is 0.52.

C Additional tables and figures

Table A.1: Effect of Commodity Price Shocks on Industrial Production: Full Results

	Model 1		Model 2	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A. OLS y IV				
dep Var: Growth rate Industrial GDP Per Capita				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	0.0035	-0.0586^{**}	0.0053	-0.0513^{**}
	(0.0083)	(0.0249)	(0.0089)	(0.0249)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.1046^{***}	0.1053^{***}	0.1134^{***}	0.1140^{***}
	(0.0241)	(0.0244)	(0.0224)	(0.0227)
log(Banana Suit) $\times \Delta log$(Banana Price)			0.0113^{***}	0.0050
			(0.0036)	(0.0040)
log(Palm Suit) $\times \Delta log$(Palm Price)			0.0032^{*}	0.0029
			(0.0020)	(0.0019)
log(Tobacco Suit) $\times \Delta log$(Tobacco Price)			-0.0226^{***}	-0.0235^{***}
			(0.0072)	(0.0072)
log(Sugar Suit) $\times \Delta log$(Sugar Price)			0.0027^{***}	0.0091^{***}
			(0.0028)	(0.0037)
Coffee Effect	0.019	-0.328	0.030	-0.287
Oil Effect	0.006	0.006	0.007	0.007
F-Stat	–	37.66	–	36.69
R^2	0.276	0.259	0.285	0.272
	Model 1		Model 2	
Panel B. First stage				
dep Var: log(Coffe Suit) $\times \Delta log$(Coffee Price)				
log(Coffe Suit) $\times \Delta log$(Export: Top 3)	-0.5966^{***}		-0.6440^{***}	
	(0.1137)		(0.1223)	
Obs	8433		8433	
N Mun	937		937	
Municipal and Year FE	✓		✓	
Region Trends	✓		✓	
Baseline Controls	✓		✓	
Geographic Controls	✓		✓	

Notes: Results from estimating the equation (7) via MCO and 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in (Dube & Vargas, 2013) and several municipalities with no information about coffee suitability. The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.2: Effect of Commodity Price Shocks on Service Production: Full Results

	Model 1		Model 2	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A. OLS y IV				
dep Var: Growth rate Service GDP Per Capita				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	0.0017	0.0012	0.0024	0.0027
	(0.0025)	(0.0071)	(0.0028)	(0.0069)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.0076	0.0076	0.0066	0.0066
	(0.0048)	(0.0048)	(0.0049)	(0.0049)
log(Banana Suit) $\times \Delta log$(Banana Price)			0.0001	0.0001
			(0.0017)	(0.0017)
log(Palm Suit) $\times \Delta log$(Palm Price)			0.0003	0.0003
			(0.0005)	(0.0005)
log(Tobacco Suit) $\times \Delta log$(Tobacco Price)			0.0029*	0.0029*
			(0.0017)	(0.0017)
log(Sugar Suit) $\times \Delta log$(Sugar Price)			−0.0011*	−0.0012*
			(0.0011)	(0.0014)
Coffee Effect	0.020	0.014	0.029	0.032
Oil Effect	0.001	0.001	0.001	0.001
F-Stat	–	37.66	–	36.69
R^2	0.197	0.197	0.199	0.199
Obs	8433		8433	
N Mun	937		937	
Municipal and Year FE	✓		✓	
Region Trends	✓		✓	
Baseline Controls	✓		✓	
Geographic Controls	✓		✓	

Notes: Results from estimating the equation (7) via MCO and 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in (Dube & Vargas, 2013) and several municipalities with no information about coffee suitability. The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.3: Industrial Production and Price Shocks: Different Specifications

	IV (1)	IV (2)	IV (3)	IV (4)
Panel A. Second Stage				
dep Var:				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	-0.0544^{**}	-0.0360^{*}	-0.0400^{*}	-0.0614^{**}
	(0.0215)	(0.0210)	(0.0213)	(0.0283)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.1751^{***}	0.1814^{***}	0.1882^{***}	0.1333^{***}
	(0.0234)	(0.0241)	(0.0240)	(0.0234)
Coffee Effect	-0.305	-0.201	-0.224	-0.343
Oil Effect	0.010	0.011	0.011	0.008
F-Stat	62.51	55.97	54.40	29.35
R^2	-0.002	0.113	0.131	0.294
Panel B. First stage				
dep. Var: log(Coffee Suit) $\times \Delta log$(Coffee Price)				
log(Coffe Suit) $\times \Delta log$(Export: Top 3)	-0.7518^{***}	-0.7306^{***}	-0.7292^{***}	-0.6242^{***}
	(0.1179)	(0.1174)	(0.1175)	(0.1234)
Obs	8433	8433	8433	8433
N Mun	937	937	937	937
Municipal and Year FE	✓	✓	✓	✓
Region Trends	✗	✓	✓	✓
Baseline Controls	✗	✗	✓	✓
Geographic Controls	✗	✗	✗	✓

Notes: Results from estimating the equation (7) via 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in (Dube & Vargas, 2013). The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.4: Service Production and Price Shocks: Different Specifications

	IV (1)	IV (2)	IV (3)	IV (4)
Panel A. Second Stage				
dep Var:				
log(Coffe Suit) $\times\Delta log$(Coffee Price)	-0.0016	-0.0007	-0.0015	0.0030
	(0.0063)	(0.0059)	(0.0059)	(0.0076)
log(Oil Prod) $\times\Delta log$(Oil Price)	-0.0004	-0.0011	-0.0008	0.0057
	(0.0053)	(0.0056)	(0.0056)	(0.0048)
Coffee Effect	-0.019	-0.008	-0.018	0.036
Oil Effect	-0.000	-0.000	-0.000	0.001
F-Stat	62.51	55.97	54.40	29.35
R^2	0.010	0.114	0.125	0.250
Obs	8433	8433	8433	8433
N Mun	937	937	937	937
Municipal and Year FE	✓	✓	✓	✓
Region Trends	✗	✓	✓	✓
Baseline Controls	✗	✗	✓	✓
Geographic Controls	✗	✗	✗	✓

Notes: Results from estimating the equation (7) via 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in Dube and Vargas (2013). The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.5: Robustness: Other Measures of Agricultural Productivity

	Growth rate Industrial GDP Per Capita		Growth rate Services GDP Per Capita	
	(1)	(2)	(3)	(4)
Panel A. Second stage				
log(Coffee Yield) $\times\Delta log$(Coffee Price)	-0.0866^{**}	-0.0817^{**}	0.0100	0.0103
	(0.0368)	(0.0359)	(0.0124)	(0.0124)
log(Oil Prod) $\times\Delta log$(Oil Price)	0.1177^{***}	0.1166^{***}	0.0053	0.0076
	(0.0230)	(0.0233)	(0.0046)	(0.0053)
Coffee Effect	-0.492	-0.465	0.132	0.136
Oil Effect	0.007	0.007	0.001	0.001
F-Stat	42.39	43.11	42.39	43.11
R^2	0.251	0.254	0.215	0.216
Panel B. First stage				
dep Var: log(Coffe Yield) $\times\Delta log$(Coffee Price)				
log(Coffe Yield) $\times\Delta log$(Export: Top 3)	-0.6221^{***}	-0.6278^{***}	-0.6221^{***}	-0.6278^{***}
	(0.1073)	(0.1073)	(0.1073)	(0.1073)
Obs	8766	8766	8766	8766
N Mun	974	974	974	974
Municipal and Year FE	✓	✓	✓	✓
Region Trends	✓	✓	✓	✓
Baseline Controls	✓	✓	✓	✓
Geographic Controls	✓	✓	✓	✓

Notes: Results from estimating the equation (7) via 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals), as in Dube and Vargas (2013), and several municipalities with no information about coffee suitability. The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. For sugar, palm, coffee, banana, and tobacco, the measure of productivity is defined as $log(Yield + 0,1)$. Yield is defined as the production per hectare. When the production of a given good is zero, the yield is assigned to be zero. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.6: Robustness: Alternative Definitions of the Instrument

Instrument	Exports 6 Main Producers		Exports 9 Main Producers	
Dep Var	Growth rate		Growth rate	
	Industry	Services	Industry	Services
	(1)	(2)	(3)	(4)
Panel A. Second stage				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	-0.1206^{***}	0.0061	-0.0875^{**}	0.0064
	(0.0463)	(0.0125)	(0.0349)	(0.0098)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.1333^{***}	0.0032	0.1330^{***}	0.0032
	(0.0281)	(0.0038)	(0.0275)	(0.0038)
Coffee Effect	-0.675	0.075	-0.490	0.078
Oil Effect	0.008	0.000	0.008	0.000
F-Stat	17.96	17.96	27.77	27.77
R^2	0.193	0.174	0.222	0.174
Panel B. First stage				
dep Var: log(Coffe Suit) $\times \Delta log$(Coffee Price)				
log(Coffe Suit) $\times \Delta log$(Exports)	-0.1373	-0.1373	-0.2628^{**}	-0.2628^{**}
	(0.1394)	(0.1394)	(0.1191)	(0.1191)
Obs	8433	8433	8433	8433
N Mun	937	937	937	937
Municipal and Year FE	✓	✓	✓	✓
Region Trends	✓	✓	✓	✓
Baseline Controls	✓	✓	✓	✓
Geographic Controls	✓	✓	✓	✓

Notes: Results from estimating the equation (7) via 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in Dube and Vargas (2013). The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. TThe 6 main producers are Brazil, Vietnam, Indonesia, India, Honduras, and Guatemala. The 9 main producers are these six countries plus Peru, Uganda, and Ethiopia. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.7: Placebo Test: Using Countries with Lower Participation in the Coffee Market

	Growth rate		Growth rate	
	Industry	Services	Industry	Services
	(1)	(2)	(3)	(4)
Panel A. Second Stage				
log(Coffe Suit) $\times \Delta log$(Coffee Price)	0.0088	0.0027	0.0051	0.0019
	(0.0163)	(0.0044)	(0.0190)	(0.0049)
log(Oil Prod) $\times \Delta log$(Oil Price)	0.1179***	0.0061	0.1179***	0.0061
	(0.0216)	(0.0048)	(0.0216)	(0.0048)
Coffee Effect	0.049	0.032	0.028	0.023
Oil Effect	0.007	0.001	0.007	0.001
F-Stat	75.22	75.22	76.28	76.28
R^2	0.282	0.198	0.282	0.198
Instrument	Exports Exports of Ranking 10 to 12		Exports Exports of Ranking 10 to 15	
Panel B. First Stage				
Dep Var: log(Coff Suit) $\times \Delta log$(Coffee Price)				
log(Coffe Suit) $\times \Delta log$(Exports)	0.6014***	0.6014***	0.8131***	0.8131***
	(0.0677)	(0.0677)	(0.0910)	(0.0910)
Obs	8433	8433	8433	8433
N Mun	937	937	937	937
Municipal and Year FE	✓	✓	✓	✓
Region Trends	✓	✓	✓	✓
Baseline Controls	✓	✓	✓	✓
Geographic Controls	✓	✓	✓	✓

Notas: Results from estimating the equation (7) via 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in Dube and Vargas (2010). The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. The 10 to 15 ranking are Mexico, Côte d'Ivoire, Nicaragua, Papua New Guinea, El Salvador, and Costa Rica. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

Table A.8: Robustness: Other Measures of Oil Production

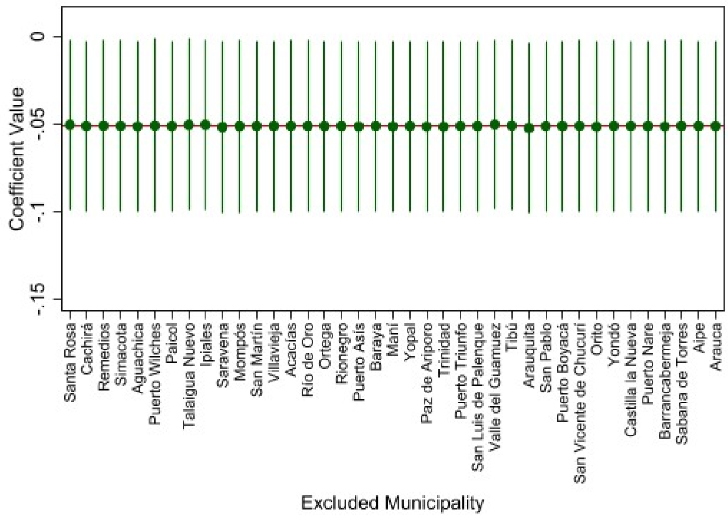
	Growth rate		Growth rate	
	Industry	Services	Industry	Services
	(1)	(2)	(3)	(4)
Panel A. Second Stage				
log(Coffe Suit) $\times\Delta log$(Coffee Price)	-0.0512^{**}	0.0028	-0.0512^{**}	0.0027
	(0.0250)	(0.0069)	(0.0250)	(0.0069)
log(Oil Prod) $\times\Delta log$(Oil Price)	0.0284^{**}	-0.0034	0.1120^{***}	0.0055
	(0.0132)	(0.0024)	(0.0217)	(0.0048)
Coffee Effect	-0.287	0.034	-0.286	0.033
Oil Effect	0.031	-0.008	0.007	0.001
F-Stat	36.67	36.67	36.67	36.67
Oil Production Measure	Oil Production in 2010		Oil Production in 1988 if $Oil^{10}_{i,r(i)} > 0$	
Panel B. First Stage				
dep Var: log(Coffee Suit) $\times\Delta log$(Coffee Price)				
log(Coffe Suit) $\times\Delta log$(Exports)	-0.7786^{***}	-0.7786^{***}	-0.7786^{***}	-0.7786^{***}
	(0.1256)	(0.1256)	(0.1256)	(0.1256)
Obs	8433	8433	8433	8433
N Mun	937	937	937	937
Municipal and Year FE	✓	✓	✓	✓
Region Trends	✓	✓	✓	✓
Baseline Controls	✓	✓	✓	✓
Geographic Controls	✓	✓	✓	✓

Notas: Results from estimating the equation (7) via 2SLS from a balanced panel. The unit of observation is the municipality-year and the sample leaves out the largest municipal units (some department capitals) as in Dube and Vargas (2013). The period is 2000-2009. The number of municipalities is given in the row N mun. Standard errors adjusted for spatial correlation (100 km) and temporal correlation in parentheses. The baseline controls refer to the predetermined variables interacted with the full set of year dummies. Region Trends refer to differential trends by region. Geographic controls refer to geographic variables multiplied by time dummies. F-Stat is the Kleibergen-Paap F statistic. *** p<0.01, ** p<0.05, * p<0.1

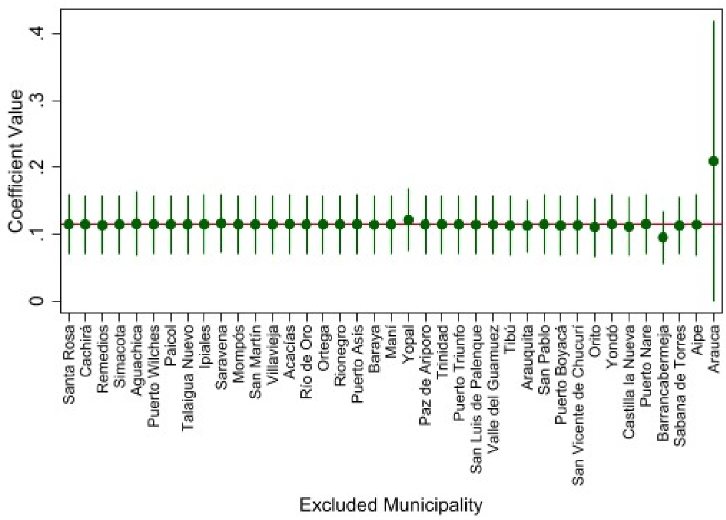
Table A.9: Industry Classification

CIIU Rev 3 Code	Description
Panel A: ***Export-Oriented Industries***	
15	Manufacture of food and beverage products
18	Manufacture of clothing, preparation and dieing hides
19	Tanning and preparation of leathers; manufacture of footwear; manufacture of travel articles, suitcases, handbags and similar; articles of leatherworking and harnesses
22	Activities of editing and printing and reproduction of recordings
23	Coke production, manufacture of products of refining petroleum and nuclear combustion
26	Manufacture of other products made from non-metallic minerals
36	Manufacture of furniture, manufacturing industries not in another category
Panel B: ***No Export-Oriented Industries***	
16	Manufacture of tobacco products
17	Manufacture of textile products
20	Transformation of wood and manufacture of wood and cork products, except furniture; manufacture of baskets and woven vegetation
21	Manufacture of paper, cardboard and paper and cardboard products
24	Manufacture of chemical substances and products
25	Manufacture of rubber and plastic products
27	Manufacture of basic metallurgic products
28	Manufacture of products made from metal, except machinery and equipment
29	Manufacture of machinery and equipment [Ncp=not in another category]
30	Manufacture of office, accounting and informatics machinery
31	Manufacture of electrical machinery and appliances not in another category
32	Manufacture of radio, television and communications equipment and appliances
33	Manufacture of medical, optical and precision instruments and watch manufacturing
34	Manufacture of automobile, towing and semi-towing vehicles
35	Manufacture of other types of transportation equipment

Notas: This table show the industries acording to the classification described in section 7.



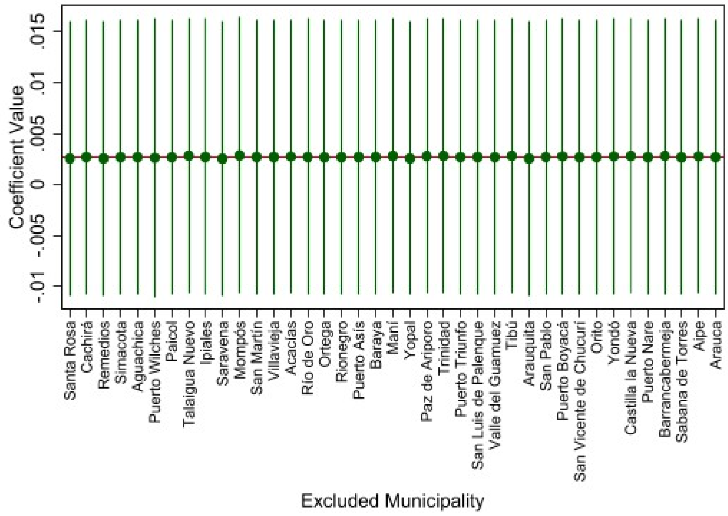
(a) $\boldsymbol{\beta}^{coff}$



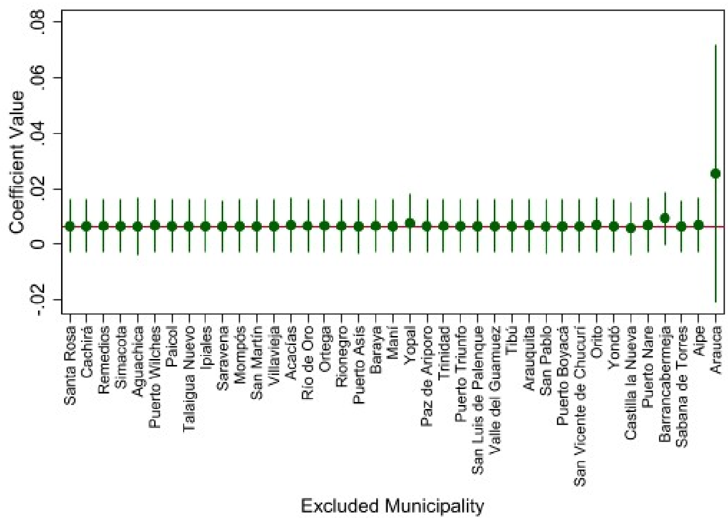
(b) $\boldsymbol{\beta}^{Oil}$

Figure A.1: Dropping one Oil Producer Municipality: Industry

Notes: Coefficients and 95 percent confidence intervals of $\boldsymbol{\beta}^{coff}$ and $\boldsymbol{\beta}^{Oil}$ resulting from re-estimating the equation (7) with industry GDP growth as the independent variable eliminating one oil-producing municipality in 1988 at a time. Standard errors corrected for spatial correlation. The red line shows the estimated value using the full sample



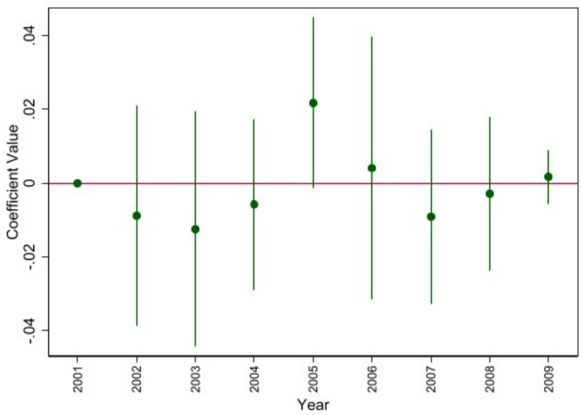
(a) $\boldsymbol{\beta}^{coff}$



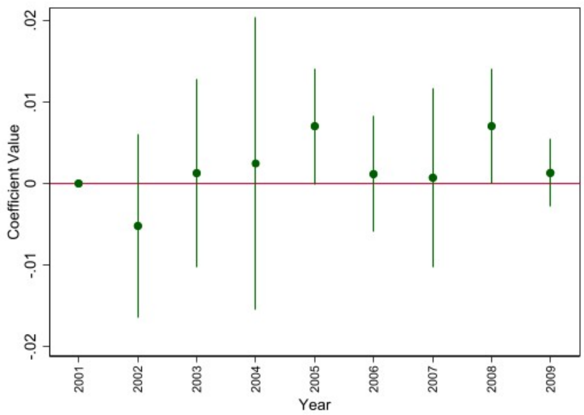
(b) $\boldsymbol{\beta}^{Oil}$

Figure A.2: Dropping one Oil Producer Municipality: Services

Notes: Coefficients and 95 percent confidence intervals of $\boldsymbol{\beta}^{coff}$ and $\boldsymbol{\beta}^{Oil}$ resulting from re-estimating the equation (7) with service GDP growth as the independent variable eliminating one oil-producing municipality in 1988 at a time. Standard errors corrected for spatial correlation. The red line shows the estimated value using the full sample.



(a) Industry



(b) Services

Figure A.3: Differential trends from municipalities not included in the main sample

Notes: Coefficients and 95 percent confidence intervals of $\boldsymbol{\eta}^s$ resulting from estimating the following equation

$$\Delta y_{i,r(i),t} = \mu_{i,r(i)} + \xi_t + \delta_{r(i)}t + \sum_{s=2002}^{2009} \boldsymbol{\eta}^s (Sample_{i,r(i)} \times \xi_s) + \boldsymbol{\alpha}' X_{i,r(i),t} + \varepsilon_{i,r(i),t}$$

with $\Delta y_{i,r(i),t}$ being the growth rate of industry GDP per head, Panel (a), or service GDP per head, Panel (b). $Sample_{i,r(i)}$ is an indicator variable for being in the sample for the main results and in the specification is interacted with the time fixed effect, ξ_s . Standard errors corrected for spatial correlation. All the baseline and geographic controls are used in the specification. The red line is in zero.