# Dollarization of agricultural costs in Argentina

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## Abstract

This article analyzes the determinants of agricultural costs in Argentina, giving special attention to their degree of dollarization. To estimate the dollarization of agricultural costs, an agricultural cost base by region was calculated for the country's three primary crops, to which panel econometrics were then applied. The present article argues that incorporating this dimension of analysis is vital when designing compensated devaluation schemes, given that a high degree of dollarization reduces such schemes' effectiveness as a mechanism for decoupling prices without distributive effects. This research contributes empirical evidence drawn from the technological and organizational transformations in the agricultural sector with which to rethink the traditional recommendations of the economic policies of Argentina's productive structure.

**Keywords:** agricultural costs; dollarization; agricultural crops; agricultural policy; econometric analysis.

## 1. INTRODUCTION

The Argentine farming sector has undergone great changes at the technological and organizational level in the last 40 years. As a result, production has grown threefold, the area sown has doubled and soy has gone from being a marginal crop to representing half of farming production. Such transformations have led various authors to rethink this activity and contemplate the existence of a new age of Argentine farming (Teubal, 2001; Trigo, 2005; Bisang *et al*., 2008; Gras and Hernández, 2016).

Farming is not exempt from the globalization process seen in industry starting in the 1960s. In effect, within the academic field there is a certain consensus that, as in the industrial sector, the agrarian sector as gone on to organize itself according to the logic of a globalized chain, with a predominance of multinational companies in key links. One aspect upon which these viewpoints agree is that multinational companies linked to chemical and bio-technical development command the innovation process, as they spread and are responsible for the primary transformational technologies and changes in the regulatory frameworks for the approval of new technologies (Teubal, 2001; Pengue, 2005; Bisang *et al*., 2010). Various works point out that the sector has gone on to set itself up like a global value chain (GVC) (Humphrey and Memedovic, 2006; Bisang *et al*., 2010; Lee *et al*., 2012).

Some analyses on the changes in the farming sector focus on the costs (Bisang *et al.*, 2008; Makler, 2008; Pierri, 2017; CREA, 2018). Along these lines, Bisang *et al*. (2008) point out that the pre-eminence of truly tradable commodities was helped along by the direct dollarization[1] of various key consumables. This aspect has taken on an important role in public debate within the context of the exchange volatility which has afflicted Argentina since 2018.

Now what is the actual magnitude that dollarization actually reaches? How does it affect the makeup of economic policy?

Particularly, if agricultural costs are dollarized, the use of an *offset devaluation* (*devaluación compensada*)[2] should be re-examined. Along these lines, the current work analyzes if the impact of this policy, native to semi-industrialized and food producing countries, has been altered by technological change and the transnationalization of the farming sector. In this regard, this works seeks to create a contribution from the perspective of a peripheral country to recent academic discussions which point out that the impact of macroeconomic policies has been modified due to globalization and production's organization in GVCs (Kosacoff and López, 2008; Gereffi and Sturgeon, 2013; OECD, 2018).

The research presents a quantitative design and turns to the analysis of semi-structured interviews[3] to explain the determinants of agricultural costs and to construct econometric models with which the impact of the exchange rate on costs is estimated.

This article is structured in five sections. Section 2 develops the origin and use of *offset devaluations*, and the determinants of agricultural costs are analyzed. Section 3 explains the methodology and information sources used in order to estimate the dollarization of agricultural costs. Section 4 presents the results, particularly the elasticity of different types of cost in relation to the exchange rate by crop. Lastly, in the fifth section, the conclusions are laid out and we present a discussion on associated economic policies.

## 2. ANALYSIS FRAMEWORK

### *Argument surrounding exchange policy for development*

Various authors testify to the convenience of applying a stable and competitive real exchange rate (SCRER) in peripheral semi-industrialized economies (Frenkel and Ros, 2006; Bresser-Pereira, 2007; Rodrick, 2007). There are three primary paths by which a real high and stable exchange rate is beneficial for the economy (Frenkel and Ros, 2006):

*a)* Growth path: by reducing local production costs in dollars, this policy allows expanding the production of tradable commodities by strengthening their standing in the domestic and foreign market.

*b)* Labor intensity path: based on a SCRER modifying the increase in elasticity between economic growth and employment, by relatively reducing the cost of manual labor below the cost of capital goods (particularly those which are imported). As such, the creation of jobs stemming from the increased economic activity is bolstered by this.

*c)* Development path: in the long-term SCRER gives way to the rise and consolidation of new and more complex productive activities. As such, the thrust in production of tradable commodities stands out as being strategic in nature for developing countries, as in the sector one finds greater possibilities to learn by doing and technological spillover into the rest of the economy (Razmi *et al*., 2012).

Nevertheless, the strategy of SCRER for attaining economic development has received a variety of criticisms from the perspective of a semi-industrialized economy specializing in agrarian production. The critics point to proposed relationships not being fulfilled and the regressive effects with regards to income distribution that this policy entails.

The first group of criticisms focuses on the growth channel. In agreement with the arguments for a contracted devaluation (Díaz Alejandro, 1963), it points out that in the short-term, depreciative movements for reaching a competitive exchange rate give way to increased prices which result in a reduction of real wages; the result will be a lower level of economic activity. In the medium-term, if domestic demand does not recover due to the new more regressive income distribution, the effect on economic growth of the new relative prices can be completely canceled out (Fiorito *et al*., 2015; López, 2008).

On the other hand, the impact on exports could be limited. The only products which can be sold under the new relative prices in the foreign market are those that found themselves close to their profitability threshold and whose competitiveness in the world market is via pricing (Crespo and Lazzarini, 2012). Likewise, an increase in a country's exports, due to a devaluation, would imply a lower market share for other exporting countries, who could themselves use the same devaluationary strategy in order to fix the situation (Dvoskin and Feldman, 2015).

In regards to the employment channel, an increase in the exchange rate does not necessarily result in an increase in labor intensity. An inverse causality does not exist between the price of factors and their demand. In order to produce a specific good, different types of capital goods are used, so capital itself cannot be thought of in a homogeneous manner. The problem is that production may then not be increased via labor intensity if one does not physically modify the repertoire of capital goods. In this regard it is possible that a true substitution of capital for labor can only come about by lowering the real salary to a minimum below the cost of living (Fiorito *et al*., 2015; Dvoskin and Feldman, 2015).

The third criticism points to the sustainability of the system. According to the analysis carried out by Diamand (1972), upon reducing the purchasing power of wages the devaluations bring about a strong distributive push where workers try to gain back what they lost. This creates, generally, a spiral of prices and salaries which raises the value of non-tradable commodities to that of tradable ones (Kicillof and Nahón, 2007; Dvoskin and Feldman, 2015).

The ensemble of developed criticisms leads one to understand why economies, like Argentina's, based on the export of food cannot achieve the relationships proposed by the first group of authors. Faced with these distinct traits of the Argentinian productive framework, Diamand (1972) finds a possible alternative to the stabilization program of 1967, which he classifies as *offset devaluation*. This program meant both a devaluation of the nominal exchange rate with an increase in export rights. The result was an increase in the real exchange rate for the industry while that of farming was kept stable. In general, an *offset devaluation* is defined as that which mitigates or cancels a devaluation's inflationary and regressive effects on income distribution (López and Pacheco, 2002). Given the Argentinian productive framework, this would primarily be achieved by export rights for farming products. As such the aim of this measure is to avoid a regressive, and therefore recessive, impact which comes about from an increase in food prices after a devaluation, while favoring the least competitive sector in regards to exchange rates (Abeles and Panigo, 2015).

This article seeks to contribute to the design of *offset devaluations* for semi-industrialized economies where the farming industry dominates. It thereby argues that structural changes in farming value chains present new challenges which must be incorporated in the theory. This is due to the fact that if costs are found totally or partially dollarized, the application of an export right of the necessary magnitude to avoid local prices being affected by the devaluation would entail part of the pre-existing farming surplus, given the resulting cost increase in the domestic currency. This phenomenon exposes the political implications which could condition or alter the efficacy of *offset evaluations.*

### *Determining agricultural costs*

The reason why agricultural costs are dollarized is political in nature can be traced back to 2002, when farming entities complained that "[that year's] devaluation had not benefited the farming sector; on the contrary, not only did it not improve the competitiveness of the country, but it also increased the cost of consumables and deteriorated relative prices" (Makler, 2008, p. 10).With regards to said period of devaluation, Pierri (2017) points out that the production costs in the domestic currency increased 181% between 2001 and 2002, far above the increase in the consumer price index (29.5%). He concludes that the producers' extraordinary increase in income in the local currency, brought about by the devaluation, was weakened by the increase in income by contractors and consumable supply companies.

These proposals are found to coincide with Bisang (2007, p. 220) who points out that:

> The new makeup of the productive framework, joined with a greater predominance of "the industrial" in farming and along with the presence of truly tradable commodities creates a type of "dollarization" directly from various key consumables of the model.

This study shall next present a description of the determinants for the primary agricultural costs and the evolution in the new productive model.

### *Seeds*

The cost of producing a guaranteed seed first brings about the initial cost of the same commodity which it seeks to produce. To this one must add the cost of bagging and guarantees, planning, marketing and the indirect cost of innovation. Likewise, when the transgenic event or the germplasm finds itself patented, one must add the payment of royalties. Local businesses which participate in developing seeds do so by using patented transgenic events, often with germplasms as well, for whose use they must pay royalties to some multinational company. In this regard, an executive of an important local seed company stated in 2018 that for domestic companies the royalties of using the transgenic event and the germplasm to develop an intact seed represented 60% of production costs (interview carried out in May 2018). According to a member of the research team of the magazine *Farming Margins* (*Márgenes Agropecuarios*),[4] in the case of unguaranteed seeds, the cost of the grain on the market becomes an even more relevant part of the total cost (interview carried out in December, 2018). The price of an unguaranteed seed is established based on the total price of the grain plus the cost of cleaning, the germinative analysis (laboratory cost), and of storage and bagging.

As such the primary dollarized costs of seeds are two: the payment of royalties which are set in dollars and is a very relevant factor in the case of the newest guaranteed seeds which still have a valid patent; the price of the commodity, as grain from the previous harvest becomes a production consumable in both the case of guaranteed seeds as well as that of unguaranteed seeds. It is important to add that the seed's degree of tradeability has increased, particularly in the case of maize (Ministerio de Agroindustria, 2016).

### *Agrochemicals and fertilizers*

Since the Green Revolution, the use of agrochemicals has become on relevant. They are mostly developed and, at least initially, produced by multinational companies which cater to the whole world. It is worth pointing out that even though the patents for herbicides and fertilizers have a limited life, large brands constantly develop new innovations with which they maintain their dominance in the market. Nevertheless, even when patents expire, the prices tend to be set on international terms, which are linked to the degree of international tradeability these products acquired as a result of the homogenization process of productivity techniques at the global level. The primary active ingredients of agrochemicals are both imported as well as locally produced and exported. Such is the case of herbicides A 2, 4 D, acetochlor, atrazine and Glyphosate as well as the insecticide Cypermethrin. The same happens with fertilizers of every kind. Likewise, among basic consumables for agrochemical and fertilizer production we find that petroleum stands out as its price is set at an international level. Lastly, a central element in explaining the evolution of agrochemical prices, which came up in the interview carried out with a researcher from CREA, is their positive relationship with the price of grains (interview carried out in October, 2018). This is due to disagreements over the appropriation of the surplus within the chain.

### *Farm work*

The primary costs of farm work are manual labor, diesel and the amortization of machinery. It deals with the most intensive work and, as such, with the greatest incidence of costs in domestic currency. Despite this, the move to direct sowing implies a smaller number of jobs per hectare as it eliminates the task of plowing the field and related tasks (Lódola, 2008). This dynamic could have a dollarization of costs upon reducing those related to manual labor. Likewise, the internal tasks (which in addition to planting includes harvesting and tasks related to caring for the crops) tended to replace labor with capital, with which there was a displacement in a cost typically expressed in domestic currency (wages), for one which is more dollarized: the cost of machinery and its amortization. This underwent several phases. Initially the import of machinery stood out, but in the last two years there was an important process of import substitution. Nevertheless, given the increasing importance had by exports and the content imported by local productions (parts), the prices tend to move in line with international ones. The price of diesel[5] , which has a greater level of tradeability, acquired greater relevance, as tasks were along with the mechanized.

### *Harvest*

The harvest, in spite of using similar production consumables, follows a different logic in determining its price. First, for the harvest one needs a greater scale, which is why the method of using contractors dominates, as is reflected by the 2018 National Farming Census[6] (INDEC, 2020). Second, the contracts are for the most part based on a percentage of the harvest. The generalization of this system implied a growing importance of the international price in determining its cost, and as such, a direct relationship with the exchange rate. A researcher from a well-known producers' association highlighted that said percentage tends to vary between 5 and 7% of that harvested, fluctuating according to variations in the yield and prices (interview carried out in December, 2018). The cost of the harvest, for its part, can vary between regions due to the greater or lower offering of available equipment (Vilulla and Chen, 2015).

### *Commercialization*

The expenses of commercialization are divided between shipping and the tasks of harvesting and conditioning the grains. According to the *Farming Margins* magazine, the tasks of conditioning in the case of soy are primarily drying and sifting, for maize shucking and drying and for wheat threshing. Shipping is divided into two: short and long-range. The first goes from the field to the warehouse, and the latter from there to the port. Shipping represents between 60 and 90% of commercial expenses in all crops and regions, registering a smaller incidence in the case of soy as it is the crop with more tasks related to conditioning. Likewise, it should be pointed out that the closer the field is to the port, the lower the shipping cost. For example, in 2016 shipping represented 60.8% of total expenses in the North of Buenos Aires, and 83% in Salta according to *Farming Margins*. Shipping is set and paid in Argentine pesos. Meanwhile, harvesting and conditioning expenses are more commonly dollarized as they are set as a percentage of the harvest and, as such, are directly related to international prices. This means that they are directly related to the exchange rate.

## 3. METHODOLOGY

### Database and econometrics

With the aim of quantifying the degree of dollarization of the costs, a panel base was designed, containing the principal costs in dollars for each of the three primary crops in the Argentine countryside: soy, wheat and maize. This selection is because these three represent 87.1% of Argentinian agrarian production.

The term "data panel" refers to the sampling of cross-section observations of dependent variables (cost of farm work, cost of seeds, cost of agrochemicals, harvesting costs and commercialization expenses) and independents over time. The information on costs was obtained from the *Farming Margins* magazine, which each month publishes data on costs and margins in dollars for the farming sector. In order to carry out the estimations which concerned the proposed objective I used data regarding top quality soy[7] (which from now on shall be referred to as simply soy), maize and wheat for the period between January 2003 and December 2016. While the data is originally monthly in nature, it was grouped by quarter with the aim of reducing volatility and increasing the explanatory power of the models. The selection of the period is due to three factors: *1)* to analyze a period of time where production techniques which characterize the new Argentinian farming predominate, *2)* in which volatility in the nominal and real exchange rate is registered and *3)* which contains a high number of observations.

The sampling contains 168 monthly observations and 56 quarterly ones for five regions in the case of maize, four in the case of wheat and three for soy (see Table 1). For each crop and region there are two types of different yields. Likewise, for some of the primary regions there is information on more than one technique. From all the regions and techniques with available data, only those which presented data for the total period analyzed were selected.

Table 1. Series by crop, region, technique and yields for the period of 2003 – 2016

| *ID* | *Crop* | *Región* | *Technique*[a] | *Yield*[b] | *Observations* | *Start date* | *End date* |
|---|---|---|---|---|---|---|---|
| 11 | Maize | N. Buenos Aires - S. Santa Fe | 1 | 75 | 168/56 | Jan-03 | Dec-16 |
| 12 | Maize | N. Buenos Aires - S. Santa Fe | 1 | 95 | 168/56 | Jan-03 | Dec-16 |
| 21 | Maize | N. Buenos Aires - S. Santa Fe | 2 | 75 | 168/56 | Jan-03 | Dec-16 |
| 22 | Maize | N. Buenos Aires - S. Santa Fe | 2 | 95 | 168/56 | Jan-03 | Dec-16 |
| 31 | Maize | N. Buenos Aires - S. Santa Fe | 3 | 75 | 168/56 | Jan-03 | Dec-16 |
| 32 | Maize | N. Buenos Aires - S. Santa Fe | 3 | 95 | 168/56 | Jan-03 | Dec-16 |
| 41 | Maize | W. Buenos Aires | 4 | 65 | 168/56 | Jan-03 | Dec-16 |
| 42 | Maize | W. Buenos Aires | 4 | 85 | 168/56 | Jan-03 | Dec-16 |
| 51 | Maize | S. Entre Ríos | 5 | 65 | 168/56 | Jan-03 | Dec-16 |
| 52 | Maize | S. Entre Ríos | 5 | 85 | 168/56 | Jan-03 | Dec-16 |
| 61 | Maize | SE. Buenos Aires | 6 | 70 | 168/56 | Jan-03 | Dec-16 |
| 62 | Maize | SE. Buenos Aires | 6 | 90 | 168/56 | Jan-03 | Dec-16 |
| 71 | Maize | SW. Buenos Aires | 7 | 55 | 168/56 | Jan-03 | Dec-16 |
| 72 | Maize | SW. Buenos Aires | 7 | 70 | 168/56 | Jan-03 | Dec-16 |
| 81 | Wheat | N. Buenos Aires - S. Santa Fe | 8 | 35 | 168/56 | Jan-03 | Dec-16 |
| 82 | Wheat | N. Buenos Aires - S. Santa Fe | 8 | 65 | 168/56 | Jan-03 | Dec-16 |
| 91 | Wheat | SE. Buenos Aires | 9 | 60 | 168/56 | Jan-03 | Dec-16 |
| 92 | Wheat | SE. Buenos Aires | 9 | 65 | 168/56 | Jan-03 | Dec-16 |
| 101 | Wheat | SE. Buenos Aires | 10 | 65 | 168/56 | Jan-03 | Dec-16 |
| 102 | Wheat | SE. Buenos Aires | 10 | 50 | 168/56 | Jan-03 | Dec-16 |
| 111 | Wheat | SW. Buenos Aires | 11 | 26 | 168/56 | Jan-03 | Dec-16 |
| 112 | Wheat | SW. Buenos Aires | 11 | 36 | 168/56 | Jan-03 | Dec-16 |
| 121 | Wheat | SE. Córdoba | 12 | 25 | 168/56 | Jan-03 | Dec-16 |
| 122 | Wheat | SE. Córdoba | 12 | 35 | 168/56 | Jan-03 | Dec-16 |
| 131 | Soy | N. Buenos Aires | 13 | 36 | 168/56 | Jan-03 | Dec-16 |
| 132 | Soy | N. Buenos Aires | 13 | 38 | 168/56 | Jan-03 | Dec-16 |
| 141 | Soy | W. Buenos Aires | 14 | 36 | 168/56 | Jan-03 | Dec-16 |
| 142 | Soy | W. Buenos Aires | 14 | 38 | 168/56 | Jan-03 | Dec-16 |
| 151 | Soy | SE. Buenos Aires | 15 | 26 | 168/56 | Jan-03 | Dec-16 |
| 152 | Soy | SE. Buenos Aires | 15 | 32 | 168/56 | Jan-03 | Dec-16 |

Notes: [a] Combination of consumables and labors. The numbers are indicative for differentiating the techniques; [b] Quintal produced per hectare.

Source: created by the author based on data from farming magazine *Farming Margins*.

This base provides the variables to explain, which are each type of cost (farm work, seeds, agrochemicals, harvesting, commercialization and the total) for each one of the three crops selected. In order to build the explanatory variables, we used a variety of public and private sources. The data on the exchange rate and wages comes from national public entities such as the Central Bank of Argentina (BCRA)[8] and the Ministry of Labor, respectively. Diesel prices come from the CREA database. International prices of different commodities were gathered from the International Monetary Fund (IMF). Export rights were gathered from a survey carried out by the Buenos Aires Grain Exchange[9] . Given that *Farming Margins* present the costs, measured in dollars, at the beginning of every month, I used the value of the official exchange rate on the first working day of the month to create the regressions (as it is in effect at the moment that the costs are set).[10] For the rest of the variables I will take the data from the previous month, as it is the one that influences the determination of the cost of the current month. Lastly, I will incorporate a dummy for the crop in order to register technical changes presented by the magazine and to capture variations in cost derived from this effect.[11] These breaks are registered in different periods according to the crop: soy in October 2006, maize in April 2012 and wheat in December 2011.

Table 2. Explanatory variables and variables to explain

| *Variable* | *Source* | *Unit* |
|---|---|---|
| *Explanatory variables* | | |
| Nominal exchange rate | Central Bank of Argentina | Argentine peso |
| Average wages | Ministry of Labor, Employment and Social Security | Argentine peso |
| Seed production wages s.e. | Ministry of Labor, Employment and Social Security | Argentine peso |
| Agrochemical production wages s.e. | Ministry of Labor, Employment and Social Security | Argentine peso |
| Laborers' wages s.e. | CREA | Argentine peso |
| Diesel | CREA | Argentine peso |
| Price of soy | IMF | Dollar |
| Price of maize | IMF | Dollar |
| Price of wheat | IMF | Dollar |
| Price of oil | IMF | Dollar |
| Soy export rights | Buenos Aires Grain Exchange | Exchange rate |
| Maize export rights | Buenos Aires Grain Exchange | Exchange rate |
| Wheat export rights | Buenos Aires Grain Exchange | Exchange rate |
| Soy technical change | *Farming Margins* | *Dummy* |
| Maize technical change | *Farming Margins* | *Dummy* |
| Wheat technical change | *Farming Margins* | *Dummy* |
| *Dependent variable* | | |
| Farm work | *Farming Margins* | Dollar |
| Seeds | *Farming Margins* | Dollar |
| Agrochemicals | *Farming Margins* | Dollar |
| Commercialization expenses | *Farming Margins* | Dollar |
| Harvest | *Farming Margins* | Dollar |
| Total costs | *Farming Margins* | Dollar |

Source: created by the author.

In order to create the econometric panel, we opted for a random effects model (RE). This assumes the presence of differences between regions (given the dominating production technique in each one) and the specific effect of the technique is a random variable not correlated with the covariables. RE allows estimating a different intercept for each transversal unit, in this case for each productive technique. The model is expressed as:

$$Costo_{it} = \alpha_i + \beta_1 X_{1it} + e_{it} \qquad (1)$$

where $\alpha_i = \alpha + u_i$

This means that the intercept goes from being made up of a random variable with an average in α and a random deviation in $u_i$. Substituting $\alpha_i = \alpha + u_i$ in (1), we get:

$$Costo_{it} = \alpha + \beta_1 X_{1it} + u_i + e_{it} \qquad (2)$$

The choices based on the Breusch-Pagan test reported that there are differences between techniques, which implies that each transversal unit has a different intercept which must be estimated. If these could also be estimated by fixed effects, the Hausman test showed that there are no significant differences between both models. In this regard, it behooves to use RE as upon estimating fewer parameters the degree of freedom increases. It is then logical that in the developed model the independent variables are not found to be correlated with the error, given that they are domestic in nature and the regional peculiarities should not affect them.

On the other hand, the Woolridge test detected an autocorrelation in the proposed regressions. Likewise, the Wald test and Pesaran test infer the presence of heteroscedasticity in some of the regressions and contemporary correlation in their totality. For these reasons, the RE estimations are complemented with the Feasible Generalized Least-Squares (FGLS) or the Panel Corrected Standard Errors (PCSE) (Beck, 2001) with the aim of eradicating the three problems together. Lastly, it is worth mentioning that the series were worked on using differences to eliminate the stationarity detected by the augmented Dickey Fuller test and by the Harris-Tzavalis test.

### *Specifications of the model*

With the aim of approximating the degree of dollarization of costs, we estimated the elasticity of the exchange rate for each of the primary agricultural costs. The expected result is that costs, measured and expressed in dollars, of the typical items in the new productive model (seeds and agrochemicals) have a lower sensitivity. In other words, increases in the exchange rate tend to leave the pricing in dollars unaltered in this first group. Likewise, this seeks to find out the sensitivity of total costs to exchange rate.

In Argentina, Frenkel (1986) made an important contribution for classifying direct determinants for inflation as seen in the cost approach. From his perspective prices can be split into four components: flexible prices (p. flex), exchange rate (e), salaries (w) and regulated prices (p. gob). Each one is assigned a coefficient and together they make it possible to explain the dynamics of general prices in the economy. From this analysis we get the following equation:

$$p_t = \beta_0 p_t^{flex} + \beta_1 e_t + \beta_2 w_t + \beta_3 p_t^{gob}$$

In a more recent work, Frenkel and Friendheim (2016) separated this equation into more components and incorporated an autoregressive component for prices as a factor which incorporates inflationary inertia and other factors which are not included. Likewise, estimations were carried out for Argentina based on a monthly model of first differences.

The equations which describe the behavior of agricultural costs are guided by the criteria proposed in previous works and were created taking into account the literature and the in-depth interviews with players in the sector. Like in the aforementioned works, an autoregressive component was included and the variables are presented in logarithms and first differences. It is worth pointing out that in the case of harvests a three-month moving average was applied given its volatility.

### *Farm work*

In order to quantify the impact had by the exchange rate on the cost of farm work, a control was used in the form the wages of farm laborers and the price of diesel. A dummy is also incorporated in order to register the technical change presented by the magazine and to capture variations in costs derived from this effect.

$$\begin{aligned} labranzacultivo_{i,t} &= \beta_0 + \beta_1 labranzacultivo_{i,t-1} + \beta_2 e_t + \beta_3 wpeon_t \\ &+ \beta_4 p_t^{gasoil} + \beta_5 CT_i + u_{it} \end{aligned}$$

### *Seeds*

In the case of seeds, we use as a control, wages for the sector the international price of the crop in relation to the last three quarters and retentions. The act of taking the results of a quarter is owed to what we gathered from the interviews: given that the reaction to prices tends to be delayed and proves itself to be a greater coefficient of determination when including the delayed variable. We included retentions as they influence the price which local producers get. Lastly, we also incorporated the technical change dummy.

$$\begin{aligned} semillacultivo_{i,t} &= \beta_0 + \beta_1 semillacultivo_{i,t-1} + \beta_2 e_t + \beta_3 wsemila_t \\ &+ \beta_4 p_t^{cultivo3q} + \beta_5 retcultivo_t + \beta_6 CT_i + u_{it} \end{aligned}$$

### *Agrochemicals*

In the case of agrochemicals, it is controlled with the wages of the sector, international prices for crops and oil in relation to three quarters prior. The act of including the price of crops is related to the aforementioned dispute within the chain. Oil is incorporated as it is one of the primary consumables in the production of various agrochemicals and fertilizers. Lastly a technical change dummy is added.

$$\begin{aligned} agroqcultivo_{i,t} &= \beta_0 + \beta_1\ agroqcultivo_{i,t-1} + \beta_2 e_t + \beta_3 wagroq_t \\ &+ \beta_4 p_t^{cultivo3q} + \beta_5 p_t^{petro3q} + \beta_6 CT_i + u_{it} \end{aligned}$$

### *Harvest*

As for the harvest, the control variables are wage, diesel, the current international prices and retentions. The fact that the price tends to be set in relation to the grain harvested influences the current price of the crop. As such, retentions are also incorporated as they affect the evolution of the local price of these last two.

$$cosechacultivo_{i,t} = \beta_0 + \beta_1 cosechacultivo_{i,t-1} + \beta_2 e_t + \beta_3 wpeon_t + \beta_4 p_t^{gasoil} + \beta_5 p_t^{cultivo} + \beta_6 retcultivo_t + u_{it}$$

### *Commercialization*

For the commercialization expenses we use as a control the average wage, diesel, the then relevant international prices and retentions. The first two fundamentally influence transportation costs. The last two are relevant for other tasks which make up these costs such as harvesting, drying and sifting as they are valued as a percentage of the product's selling price.

$$comercultivo_{i,t} = \beta_0 + \beta_1\, comercultivo_{i,t-1} + \beta_2 e_t + \beta_3 wmedio_t + \beta_4 p_t^{gasoil} + \beta_5 p_t^{cultivo} + \beta_6 retcultivo_t + u_{it}$$

### *Total costs*

Lastly, for the total cost we include all the aforementioned variables.

$$costocultivo_{i,t} = \beta_0 + \beta_1 costocultivo_{i,t-1} + \beta_2 e_t + \beta_3 wmedio_t + \beta_4 p_t^{gasoil} + \beta_5 p_t^{cultivo} + + \beta_6 p_t^{petro3q} + \beta_7 p_t^{cultivo3q} + \beta_8 retcultivo_t + \beta_9 CT_i + u_{it}$$

## 4. RESULTS

As was mentioned, estimations are presented for RE, FGLS and PCSE for each cost item and for the total costs. Upon analyzing the farm work results, we registered a significant and large negative impact by the exchange rate. In the case of maize, the coefficient varies between -0.54 and -0.59 depending on the model. In the case of soy, the registered impact is greater, between -0.69 and -0.70. While wheat presents a greater range between the models, registering a coefficient between -0.42 for FGLS and -0.65 for the other methods. The values of the rest of the variables are as expected. Wages and diesel, the primary consumables in this task, present positive and significant coefficients. The only exception is wages in the case of soy when estimating by random effects, where the result is positive but not significant. For its part, the technical change dummy and the autoregressive component did not turn out to be significant except in the FGLS estimation for maize.

In the case of seeds, the exchange rate effect is much less in line with what was expected. Occasionally with soy and wheat seeds, the impact of their variation is not significant. In the case of maize, RE and FGLS estimations present a coefficient which is significant and negative but with a smaller range than registered in farm work (-0.15 for RE and -0.16 in FGLS). International prices turn out to be significant in all estimations with the exception of maize in PCSE. In every case the value is positive. As was mentioned, international prices have an impact on the cost of seeds for two reasons: the first, the grain is a production consumable, and the second is the tendency had by players in the sector to be part of the greater income resulting from higher international prices. Retentions, in cases where they are significant, present a negative value, which would be in line with the negative impact on a crop's sale price that this measure causes. The workers' wages in the sector is only significant in estimations for maize with a positive value. The autoregressive component is significant in the majority of estimations and positive. Technical change has a negative value in the two cases where it presents a significance.

In the case of agrochemicals (including fertilizers) we observed a dynamic similar to the seeds sector, with which they share an industrial nature, a high degree of tradeability and in many cases a prominence of the same players. The type of exchange was not significant, with the exception of maize when estimated by RE. The price of each crop is positive and significant, which in this case seems to be related more with the intention of the players to take advantage of favorable circumstances provided by increasing international prices. In all cases the coefficient exceeded 0.4. The price of oil, a production consumable relevant for various agrochemicals and fertilizers, also turned out to be significant and positive. The sector's wages present disparate results. It is significant and positive in the case of maize in RE and FGLS estimations; it is not significant but negative in RE and PCSE estimations for wheat. The autoregressive component turns out to be significant and positive, while the technical change is not significant except in the case of wheat with RE and PCSE, where it is significant and slightly positive.

For the harvest the exchange rate is again negative for maize when using RE and FGLS, and for all estimations for wheat. Soy turned out not to be significant. In any case, the coefficients were considerably smaller in the case of farm work (around -0.08 for maize and -0.16 for wheat). Wages turned out to be significant and positive, except in PCSE estimations for soy and wheat. In all estimations the coefficient was less than 0.10. On the other hand, oil turned out not to be significant. The small relevance of primary costs in this task is associated with the form in which the price of the harvest is determined, since as it is carried out by a contractor, it is primarily set in function of the price of the product harvested, with a lower level associated with a guaranteed minimum income. Along these lines of reasoning, the prices for each crop present significant positive coefficients. When it comes to retentions, in the case where they are significant, the values are negative. Lastly, the autoregressive coefficient turned out to be significant and positive.

As was expected, in the case of commercialization expenses, the exchange rate plays an important role. The impact of its variations is significant and negative. The coefficients find themselves along the lines of -0.57 in the case of maize, -0.61 in soy and -0.50 in wheat. This dynamic is associated with the fact that the primary expense of commercialization is transportation, as its operational costs are rarely dollarized as they depend on manual labor and fuel. Essentially, both wages as well as diesel present significant and positive coefficients. The price of every crop also has positive effects, which is associated with other types of commercialization costs such as harvesting, drying and sifting which are carried out as a percentage of product delivered. The autoregressive component does not turn out to be significant.

To wrap up, for total costs the exchange rate turns out to be significant and negative with the sole exception being the estimation of wheat carried out in PCSE. As was to be expected, the impact is inferior to that registered in farm work and harvest, but greater than that attained in the other items. The average for maize is -0.23, for soy -0.27 and for wheat -0.31. The lower elasticity registered in maize could be due to the greater impact which the technological package boasts in this crop, as it is associated with a greater rhythm of technical innovations, greater barriers to entry and the difficulty of imitating the seeds of this crop (Sztulwark, 2012). The local components of costs, such as wages and diesel, present a positive value, even though its significance differs according to each estimation. Delayed international prices, both for oil and crops, are positive and significant. Not so for international prices of current crops, where only maize registers any significance. Retentions present a negative value, but are only significant in the RE and FGLS estimations for maize. The estimation of wheat by FGLS presents an unexpected result, the significant and positive value of retentions. The autoregressive component is positive and significant in the majority of estimations. Lastly, the technical change did not turn out to be significant.

Table 3. Farm work results

| *Variable* | *Maize* | | | *Soy* | | | *Wheat* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* |
| Nominal Exchange Rate | -0.5953*** | -0.5406*** | -0.5951*** | -0.7026*** | -0.6972*** | -0.6972*** | -0.6497*** | -0.4266*** | -0.6497*** |
| Farm Work | 0.0133 | -0.0644* | 0.0109 | 0.1215* | 0.0249 | 0.0249 | 0.0528 | -0.0468 | 0.0202 |
| Wages | 0.2256*** | 0.2126*** | 0.2260*** | 0.0608 | 0.1073* | 0.1073* | 0.0985** | 0.2233*** | 0.1071*** |
| Diesel | 0.3412*** | 0.3375*** | 0.3409*** | 0.2644** | 0.2609** | 0.2609** | 0.3144*** | 0.2910*** | 0.3071*** |
| Technical Change | 0.0097 | 0.0148*** | 0.0096 | 0.0085 | 0.0086 | 0.0086 | -0.0082 | -0.0085 | -0.0097 |
| Constant | 0.0025 | 0.0048 | 0.0026 | 0.0033 | 0.0023 | 0.0023 | 0.0125** | 0.0093 | 0.0134** |
| Observations | 756 | 756 | 756 | 324 | 324 | 324 | 540 | 540 | 540 |
| Group Observations | 14 | 14 | 14 | 6 | 6 | 6 | 10 | 10 | 10 |
| Observations per group | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| R2 – between | 0.4187 | | | 0.9996 | | 0.9261 | | | |
| R2 – within | 0.3797 | | | 0.3063 | | 0.4257 | | | |
| R2 – overall | 0.3798 | | | 0.3062 | | 0.4245 | | | |
| R2 | | | 0.3797 | | | 0.3159 | | | 0.4266 |
| Wald | 459.3309 | 696.6127 | 460.2611 | 140.3666 | 149.6246 | 149.6493 | 393.8168 | 134.9934 | 401.944 |

Note: *Significant to 0.05,**Significant to 0.01,***Significant to 0,001.

Source: created by the author based on the magazine Farming Margins, the Central Bank of Argentina, CREA and the Ministry of Labor.

Table 4. Seeds results

| *Variable* | *Maize* | | | *Soy* | | | *Wheat* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* |
| Nominal Exchange Rate | -0.1453** | -0.1641*** | -0.1641 | 0.0047 | 0.0054 | 0.0054 | -0.0639 | -0.0007 | -0.0608 |
| Seeds(-1) | 0.1588*** | 0.1588*** | 0.1588 | 0.2214*** | 0.2214*** | 0.2214 | 0.2091*** | 0.2091*** | 0.2091* |
| Wages | 0.2762*** | 0.2930*** | 0.2930*** | -0.0106 | -0.0107 | -0.0107 | -0.0141 | -0.0068 | -0.0051 |
| Technical Change | -0.0176** | -0.0194*** | -0.0194 | 0.0068 | 0.0067 | 0.0067 | 0.0085 | -0.0015 | 0.0083 |
| Crop price | 0.1971*** | 0.2006*** | 0.2006 | 0.6471*** | 0.6460*** | 0.6460*** | 0.4345*** | 0.3837*** | 0.4551*** |
| Crop retention | -0.2693** | -0.3019** | -0.3019 | 0.1719 | 0.1702 | 0.1702 | -0.1207 | 0.0289 | -0.1131 |
| Constant | 0.0035 | 0.0035 | 0.0035 | 0.0057 | 0.0057 | 0.0057 | 0.0092* | 0.0092* | 0.0092 |
| Observations | 742 | 742 | 742 | 318 | 318 | 318 | 530 | 530 | 530 |
| Groups | 14 | 14 | 14 | 6 | 6 | 6 | 10 | 10 | 10 |
| Observations per group | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| R2 – between | 0.9412 | | | 1 | | | 0.9642 | | |
| R2 – within | 0.2096 | | | 0.1939 | | | 0.1669 | | |
| R2 – overall | 0.2119 | | | 0.1944 | | | 0.1678 | | |
| R2 | | | 0.2052 | | | 0.1985 | | | 0.1169 |
| Wald | 197.628 | 191.2432 | 40.1999 | 75.0248 | 78.7364 | 78.7482 | 105.428 | 14.0829 | 65.9756 |

Note:*significant 20.05,**significant to 0,01,***significant to 0.001.

Source: created by the author based on the magazine *Farming Margins*, the Central Bank of Argentina, Ministry of Labor, International Monetary Fund and the Buenos Aires Grain Exchange.

Table 5. Agrochemical results

| *Variable* | *Maize* | | | *Soy* | | | *Wheat* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* |
| Nominal Exchange Rate | 0.0703* | 0.0669 | 0.0669 | -0.0206 | -0.0361 | -0.0129 | -0.0547 | -0.0034 | -0.0536 |
| Agrochemicals | 0.2291*** | 0.2390*** | 0.2390** | 0.3369*** | 0.3833*** | 0.3810*** | 0.3685*** | 0.1461** | 0.3634*** |
| Wages | 0.1168*** | 0.1185*** | 0.1185 | -0.0195 | -0.0067 | -0.0005 | -0.0993** | -0.0733 | -0.1006** |
| Oil price | 0.5650*** | 0.5630*** | 0.5630*** | 0.6140*** | 0.5945*** | 0.5554*** | 0.4012*** | 0.3772*** | 0.4022*** |
| Technical change | 0.0016 | 0.002 | 0.002 | 0.0171 | 0.0176 | | 0.0214** | 0.0196 | 0.0213** |
| Crop Price | 0.5221*** | 0.5158*** | 0.5158* | 0.4974*** | 0.4958*** | 0.5490*** | 0.5024*** | 0.4397*** | 0.5047*** |
| Constant | -0.0084* | -0.0084* | -0.0084 | -0.0082 | -0.0082 | -0.0082 | 0.0012 | 0.0012 | 0.0012 |
| Observations | 742 | 742 | 742 | 318 | 318 | 318 | 530 | 530 | 530 |
| Groups | 14 | 14 | 14 | 6 | 6 | 6 | 10 | 10 | 10 |
| Observations per group | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| R2 - between | 0.9205 | | | 0.9999 | | | 0.9959 | | |
| R2 - within | 0.4849 | | | 0.4792 | | | 0.4985 | | |
| R2 - overall | 0.486 | | | 0.4793 | | | 0.4987 | | |
| R2 | | | 0.4931 | | | 0.5184 | | | 0.493 |
| Wald | 694.9454 | 721.7716 | 80.8907 | 286.3191 | 357.7116 | 337.8379 | 520.1991 | 97.294 | 489.5134 |

Note:*significant to 0.05,**significant to 0.01,***significant to 0.001.

Source: created by the author based on the magazine *Farming Margins*, the Central Bank of Argentina, Ministry of Labor and the International Monetary Fund.

Table 6. Harvest results

| *Variable* | *Maize* | | | *Soy* | | | *Wheat* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* |
| Nominal Exchange Rate | -0.0827*** | -0.0883*** | -0.0883 | -0.0342 | -0.0319 | -0.0319 | -0.1721*** | -0.1642*** | -0.1642* |
| Harvest (-1) | 0.5768*** | 0.5122*** | 0.5122*** | 0.5261*** | 0.4751*** | 0.4751*** | 0.6120*** | 0.5925*** | 0.5925*** |
| Labor wages | 0.0705*** | 0.0690*** | 0.0690* | 0.0437*** | 0.0430*** | 0.043 | 0.0502*** | 0.0493*** | 0.0493 |
| Diesel | 0.0193 | 0.0141 | 0.0141 | -0.0302 | -0.0305 | -0.0305 | -0.0298 | -0.0256 | -0.0256 |
| Crop price | 0.1309*** | 0.1154*** | 0.1154*** | 0.1297*** | 0.1207*** | 0.1207*** | 0.1016*** | 0.1012*** | 0.1012*** |
| Crop retentions | -0.1601** | -0.1281* | -0.1281 | -0.0103 | 0.0449 | 0.0449 | -0.3608*** | -0.3241** | -0.3241 |
| Constant | 0.0017* | 0.0022** | 0.0022 | 0.0021* | 0.0024* | 0.0024 | 0.0034*** | 0.0034*** | 0.0034 |
| Observations | 2296 | 2296 | 2296 | 984 | 984 | 984 | 1640 | 1640 | 1640 |
| Groups | 14 | 14 | 14 | 6 | 6 | 6 | 10 | 10 | 10 |
| Observations per group | 164 | 164 | 164 | 164 | 164 | 164 | 164 | 164 | 164 |
| R2- between | 0.9594 | | | 0.999 | | | 0.9961 | | |
| R2- within | 0.4503 | | | 0.4486 | | | 0.4578 | | |
| R2- overall | 0.4504 | | | 0.4487 | | | 0.4581 | | |
| R2 | | | 0.3561 | | | 0.3744 | | | 0.4334 |
| Wald | 1900 | 1300 | 109.6267 | 795.146 | 589.1818 | 123.9864 | 1400 | 1300 | 203.9477 |

Note:*significant to 0.05,**significant to 0.01,***significant to 0.001.

Source: created by the author based on the magazine *Farming Margins*, Central Bank of Argentina, CREA, Ministry of Labor, the International Monetary Fund and the Buenos Aires Grain Exchange.

Table 7. Commercialization results

| *Variable* | *Maize* | | | *Soy* | | | *Wheat* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* |
| Nominal Exchange Rate | -0,5686*** | -0,5715*** | -0,5715*** | -0,6113*** | -0,6198*** | -0,6198*** | -0,5087*** | -0,5084*** | -0,5084* |
| Commercialization | 0.0527 | 0.0429 | 0.0429 | 0.0644 | 0.0509 | 0.0509 | 0.0596 | 0.0419 | 0.0419 |
| Wages | 0,2844*** | 0,2912*** | 0,2912* | 0,3056* | 0,3067* | 0,3067* | 0,2672** | 0,2522** | 0.2522 |
| Diesel | 0,2571*** | 0,2517*** | 0.2517 | 0,1615* | 0,1536* | 0,1536* | 0,2433*** | 0,2341*** | 0.2341 |
| Crop price | 0,1010*** | 0,0988*** | 0.0988 | 0,1268*** | 0,1266*** | 0,1266*** | 0,1253*** | 0,1238*** | 0.1238 |
| Crop retentions | 0.074 | 0.0711 | 0.0711 | 0.4072 | 0.3716 | 0.3716 | 0.2227 | 0.2392 | 0.2392 |
| Constant | 0.0045 | 0.0045 | 0.0045 | 0.0115 | 0.0115 | 0.0115 | 0.0045 | 0.0045 | 0.0045 |
| Observations | 756 | 756 | 756 | 324 | 324 | 324 | 540 | 540 | 540 |
| Groups | 14 | 14 | 14 | 6 | 6 | 6 | 10 | 10 | 10 |
| Observations per group | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |
| R2 – between | 0.9511 | | | 0.8613 | | | 0.9107 | | |
| R2 – within | 0.4318 | | | 0.4517 | | | 0.4125 | | |
| R2 – overall | 0.4339 | | | 0.4512 | | | 0.4124 | | |
| R2 | | | 0.431 | | | 0.4467 | | | 0.4059 |
| Wald | 574.0743 | 572.7323 | 84.2012 | 260.583 | 261.6341 | 261.3643 | 374.1559 | 369.1094 | 42.6093 |

Note:*significant to 0.05,**significant to 0.01,***significant to 0.001

Source: created by the author based on the magazine Farming Margins, Central Bank of Argentina, CREA, Ministry of Labor, International Monetary Fund, Buenos Aires Grain Exchange.

Table 8. Total cost results

| *Variable* | *Maize* | | | *Soy* | | | *Wheat* | | |
|---|---|---|---|---|---|---|---|---|---|
| | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* | *RE* | *FGLS* | *PCSE* |
| Nominal Exchange Rate | -0.2284*** | -0.2302*** | -0.2302* | -0.2714*** | -0.2692*** | -0.2692*** | -0.3121*** | -0.0698 | -0.3119*** |
| Total costs | 0.1127*** | 0.1686*** | 0.1686 | 0.2885*** | 0.3135*** | 0.3135*** | 0.2693*** | 0.0631 | 0.2513*** |
| Wages | 0.1945*** | 0.1875*** | 0.1875* | 0.0069 | 0.013 | 0.013 | 0.0425 | 0.1681 | 0.0388 |
| Diesel | 0.1028*** | 0.1098*** | 0.1098 | 0.1536** | 0.1507** | 0.1507** | 0.1477*** | 0.1606** | 0.1457*** |
| Technical change | -0.0014 | -0.0001 | -0.0001 | 0.0066 | 0.0068 | 0.0068 | 0.0069 | -0.0134 | 0.0066 |
| Price of oil | 0.2431*** | 0.2357*** | 0.2357*** | 0.2580*** | 0.2528*** | 0.2528*** | 0.1857*** | 0.1585** | 0.1885*** |
| Crop price | 0.0894*** | 0.0973*** | 0.0973* | -0.0171 | -0.0156 | -0.0156 | 0.0069 | -0.0272 | 0.0047 |
| Crop price | 0.1488** | 0.1166* | 0.1166 | 0.3384*** | 0.3313*** | 0.3313*** | 0.2228*** | 0.1981* | 0.2280*** |
| Crop retentions | -0.1638* | -0.1530* | -0.153 | -0.2439 | -0.2233 | -0.2233 | -0.1631 | 0.2743* | -0.1605 |
| Constant | -0.0023 | -0.003 | -0.003 | 0.0013 | 0.0006 | 0.0006 | 0.0031 | -0.0017 | 0.0037 |
| Observations | 742 | 742 | 742 | 318 | 318 | 318 | 530 | 530 | 530 |
| Groups | 14 | 14 | 14 | 6 | 6 | 6 | 10 | 10 | 10 |
| Observations per group | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 | 53 |
| R2 – between | 0.9831 | | | 0.9981 | | | 0.9882 | | |
| R2 – within | 0.5511 | | | 0.5918 | | | 0.5632 | | |
| R2 – overall | 0.5536 | | | 0.5916 | | | 0.563 | | |
| R2 | | | 0.5883 | | | 0.6157 | | | 0.5479 |
| Wald | 907.61 | 1100 | 174.7026 | 446.1506 | 509.6644 | 509.0729 | 669.914 | 145.6161 | 623.3929 |

Note:*significant to 0.05,**significant to 0.01,***significant to 0.001.
Source: created by the author based on the magazine *Farming Margins*, Central Bank of Argentina, CREA, Ministry of Labor, International Monetary Fund and the Buenos Aires Grain Exchange.

To sum up, in the different estimations one can appreciate how in each crop the same relationship between costs and exchange rate is repeated:

- A significant impact, and quite negative in farm work and commercialization.
- An insignificant impact, or slightly negative in cases where significance is registered, in seeds and agrochemicals.
- A negative impact for the harvest, but lighter and with a lesser degree of significance.

Table 9. Impact of exchange rate according to type of cost

| *Crop* | *Estimation* | *Farm Work* | *Seed* | *Agrochemicals Harvest* | *Harvest* | *Commercialization* | *Total Costs* |
|---|---|---|---|---|---|---|---|
| Maize | RE | -0.5953*** | -0.1453** | 0.0703* | -0.0827*** | -0.5686*** | -0.2284*** |
| | FGLS | -0.5406*** | -0.1641*** | 0.0669 | -0.0883*** | -0.5715*** | -0.2302*** |
| | PCSE | -0.5951*** | -0.1641 | 0.0669 | -0.0883 | -0.5715*** | -0.2302* |
| Soy | RE | -0.7026*** | 0.0047 | -0.0206 | -0.0342 | -0.6113*** | -0.2714*** |
| | FGLS | -0.6972*** | 0.0054 | -0.0361 | -0.0319 | -0.6198*** | -0.2692*** |
| | PCSE | -0.6972*** | 0.0054 | -0.0129 | -0.0319 | -0.6198*** | -0.2692*** |
| Wheat | RE | -0.6497*** | -0.0639 | -0.0547 | -0.1721*** | -0.5087*** | -0.3121*** |
| | FGLS | -0.4266*** | -0.0007 | -0.0034 | -0.1642*** | -0.5084*** | -0.0698 |
| | PCSE | -0.6497*** | -0.0608 | -0.0536 | -0.1642* | -0.5084* | -0.3119*** |

Note:*significant to 0.05,**significant to 0.01,***significant to 0.001.
Source: created by the author based on the magazine *Farming Margins*, Central Bank of Argentina, CREA, Ministry of Labor, International Monetary Fund and the Buenos Aires Grain Exchange.

## 5. CONCLUSIONS

This article seeks to ascertain the degree of dollarization for agricultural costs. From the estimations that were carried out, one can conclude that the impact of the exchange rate on the costs measured in dollars varies between -0.22 and -0.31 according to the crop. In other words, an increase in exchange rate of 1% generates a drop in costs in dollars in the aforementioned quantity. Three primary aspects regarding the object of study can be deduced from the preceding analysis:

– Exchange depreciations impact the incomes which the sector receives in domestic currency but also its costs, as otherwise the reduction in cost in dollars should accompany the depreciation. This effect must be taken into account at the time of analyzing how profitability evolves.

– According to the estimations, the average gross margins of the three selected crops increased with the depreciations of the exchange rate, both in dollars and the local currency. Nevertheless, this increase is ameliorated by the dollarization logic of farming consumables.

– One aspect which explains the low sensitivity of agricultural costs (in dollars) to variations in the exchange rate is the new productive model, by having raised the degree of tradeability of commodities and establishing new rules for setting prices. One can observe that the key aspects of the model (seeds and agrochemicals) are the most dollarized.

The aforementioned aspects in previous lines of thought allow one to present some reflections related to economic policy. As one can derive from the research, currency exchange depreciations have an impact on the income had by the sector, but also on its costs. This effect should be considered at the time of analyzing how profitability evolves. Likewise, an additional aspect to take into account is income dynamics according to the crop. For while in the case of soy the effect of the exchange rate is immediately felt by the prices — the due to it being a crop that is exported almost in its totality—, in the case of maize and wheat the mills and feedlots figure between the established price in the grain exchange and that effectively paid for in domestic market sales.

It is important to highlight that the export rights constitute a very relevant tool in decoupling prices, and that other taxes on the sector would find it difficult to have the same effect. Nevertheless, from the results two aspects come to light which would complicate the design of *offset devaluations*:

*a)* The negative effect on the retentions' farming surplus is not equivalent to devaluations of equal magnitude, which would result in distributive changes with political implications.

*b)* In the case that the totality of farming profits is taken up by export rights, increasing it above that level could create difficulties in the reproduction of the activity.

As a consequence, a system of *offset devaluations* which does not affect the profitability of the sector should be based on sliding retentions which follow the variables of income and costs. Nevertheless, this implies assuming that the regressive nature of offset devaluations as food would suffer increased prices based on cost increases. What is seen based on the dollarization of agricultural costs is the impossibility of implementing high currency exchange systems without altering income distribution. In this regard, the makers of economic policy, upon choosing these exchange regimes, should choose between affecting profitability in the farming chain, lowering real wages, or distributing income from another economic sector or link in the chain. As such, just like the effects of various economic policies are being re-examined at an international level in response to globalization, its effects on the farming sector presents new challenges for designing economic policies native to the periphery.

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[1] Dollarization is understood as a low or null elasticity of a cost measured in dollars to variations in the exchange rate.

[2] TL note: *Devaluación compensada* as it is understood in Argentina, refers to a devaluation accompanied with lower import tariffs to avoid an increase in prices and increased retentions on exports to reduce the deficit. In this article we shall be using “offset devaluation” to refer to this phenomenon.

[3] Refers to 12 semi-structured interviews carried out between March 2017 and March 2019. For more information see Wahren (2019).

[4] Original name in Spanish.

[5] The price of diesel in Argentina has undergone years of regulations which separated the local price from the international one.

[6] TL note: *Censo Nacional Agropecuario 2018* in the original Spanish.

[7] It should be pointed out that top quality soy represents approximately 70% of the soy crops (Bolsa de Cereales, 2018).

[8] TL note: From the Spanish name *Banco Central de la República Argentina*.

[9] TL note: *Bolsa de Cereales* in the original Spanish.

[10] In other words, the effect of depreciations which take place on a date after the publication of the magazine will be reflected in the next month’s publication. It is worth mentioning that between November 2011 and December 2015 there were four different types of exchange rate in Argentina. The one to be used will be the official exchange rate for the entire period given that the effect of the unofficial rate on inflation was small (Frenkel and Friedheim, 2016).

[11] *Farming Margins* presents costs associated with different productive techniques. The technical change reflects changes in the makeup of costs associated with introducing new technological products which result in a new combination of consumables. When the change occurs, a relevant break is registered for each crop to be captured by the aforementioned dummy variables.