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Economic Accountability in Arabica Green Coffee Supply Chains

DISSERTAÇÃO APRESENTADA À ESCOLA BRASILEIRA DE ADMINISTRAÇÃO PÚBLICA E DE EMPRESAS PARA OBTENÇÃO DO GRAU DE MESTRE

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ECONOMIC ACCOUNTABILITY IN ARABICA GREEN COFFEE SUPPLY CHAINS.

Dissertação apresentada ao Curso de Mestrado Profissional Executivo em Gestão Empresarial da Escola Brasileira de Administração Pública e de Empresas para obtenção do grau de Mestra em Administração.

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Economic Accountability in Arabica Green Coffee Supply Chains

I. Abstract

A proliferation of coffee ethical sourcing certifications has cropped up over the past two decades, yet do these certifications have a positive correlated impact on coffee farmers and how does the industry measure this impact? This study analyzes 340 coffee supply chains, representing 11% of the global green Arabica coffee production, participating in a verification program that measures the following categorical indicators: social responsibility, economic accountability, producer support, coffee processing and environment. The study finds that as Producer Support indicator scores increase, Economic Accountability scores increase, while Social Responsibility indicators have no statistical correlation to Economic Accountability scores as measured by this verification program.

II. Introduction

Growing exponentially over the last 15 years, ethical certifications are now a staple in supermarkets and cafés across the U.S. and Europe. The global retail revenue of products holding the Fair Trade certification (certified through FLOCERT) alone reached $5.9 billion in 2014. [1] The pioneer certification organization, Fair Trade, was originally designed as a market-based approach to ensure farmers in frontier and emerging markets receive a livable wage for their agriculture-based exports. The concept birthed a proliferation of for-profit companies that certify products with a 'fair trade' stamp. In this study, *fair trade,* refers to the concept detailed above, whereas the capitalized Fairtrade refers to the certifiation. Following the Fairtrade certification, a range of ethical sourcing certifications cropped up including Fair for Life, UTZ, Rainforest Alliance, C.A.F.E. Practices, Nespresso AAA, 4C, among others that are not formalized such as the 'Direct Trade' claim.

The concept of fair and direct trade was at first an ethical response to an acute supply chain and financial human rights issue, as farmers in product origin companies lived in deep poverty, while

[1] http://www.fairtrade.org.za/news/entry/global-change-local-leadership

international companies recorded large profit margins. Over the last decade, the concept of fair trade has exploded as a market niche for consumers, similar to diet fads such as 'gluten free', 'low fat,' 'paleo,' etc, yet for consumers aiming to buy ethical products that were not purchased through exploitative prices or practices. In this sense, the study of fair trade is also a marketing and branding issue as it is a supply chain and finance issue. As companies increasingly target Millennials, research and insights have shown that Millennial consumers view their food and beverage choices as an extension of their impact in the world and want to feel as if their choice is making a difference; whether that is through environmentally friendly products or purchasing ethically and/or locally sourced products.[2] In certain specialty food markets, if the product is not labeled with a fair trade certification, it can create significant concern particularly with Millennial consumers that the product was sourced unethically.

Yet, many consumers in developed economies are unaware that farmers living well below the global poverty line must pay for ethical verifications prior to receiving payment for their crops and that farmers are not guaranteed a premium price for their crop, despite receiving certification of verification. There is a lack of data both at the industry and consumer levels regarding the financial and social return that result from the financial and labor investment the farmer has made in obtaining the certification. Financially, it is not feasible for an individual smallholder farmer to be certified alone, as the cost far surpasses their annual household income. Therefore, smallholder farmers are often certified through cooperatives or through exporters that are certified by an auditing agency authorized to do so by the certifying company. The smallholder farmer then gains access to certification through being a member of a certified cooperative or selling directly to a certified exporter. The certified entity, whether it be a cooperative or exporter, is accountable for ensuring each individual farmer follows the regulations required for certification.

While this decreases the cost per farmer, the farmer could also quickly lose the certification as another member could break the regulations and the entity could lose certification through an audit finding. If the farmer invested time and money into following the certification guidelines,

[2] Barton, Christine, Koslow, Lara, Fromm, Jeff, and Eagan, Chris. "Millennial Passions: Food, Fashion and Friends." Boston Consulting Group, 2012.

then this investment is lost. On the other hand, if every member follows the guidelines, the farmer may receive a premium price for his/her coffee through certification.

In terms of economic accountability, coffee roasting companies must rely on self-reporting from the cooperative or exporter on farmer payment, certification premium payments and the timeliness of those payments. In reality, many rural farmers lack international business experience and may have limited education and are therefore at a disadvantage in advocating for their payment terms and rights.

This study analyzes one ethical verification program that grades coffee supply chains against social responsibility, economic accountability, coffee production, support to coffee producers and environmental standards The analysis will focus on the Economic Accountability and Producer Support objectives and the supply chain scores in each objective to explore the potential correlation between initiatives, while comparing the correlation with Social Responsibility scores. Specifically, this work seeks to understand the relation between the Economic Accountability and Producer Support and whether or not the Producer Support score has a statistically significant impact on Economic Accountability score.

III. Objective

Overall, this study aims to contribute to the growing body of literature on the effectiveness and relevance of coffee certification/verification programs and their direct impact, or lack thereof, on coffee farmers. Most importantly, this study seeks to add to the literature on the economic accountability and transparency in the coffee supply chain to continue to improve systems to ensure that coffee farmers receive appropriate and timely compensation for their coffee.

IV. Literature Review

This section review previous literature analyzing consumption of ethically-labeled products contrasting self-reporting with actual buying behavior as well as information reporting across the

supply chain between farmers, exporters, traders, roasting companies and consumers. Although this study is not focused on consumer beliefs and behavior regarding ethically sourced coffee, highlighting previous research on this topic is relevant, as ultimately ethical certifications/verifications are marketed towards consumers with sustainability claims.

A 2015 consumer survey suggests relatively high levels of 'self-reported Fairtrade consumption or consumer willingness to pay an ethical premium for Fairtrade products', and highlights that in 2006, two-thirds of U.S. respondents stated they were willing to pay more for ethically sourced coffee (Hertel et al,. 2009, p.455).[1] Yet in 2009, only 3% of consumers in the United States purchased Fairtrade coffee and Fairtrade green coffee purchases accounted for 2% of United States overall green coffee purchases.[2]

The study analyzed the effect of three different treatments: 1) Additional information about Fairtrade; 2) A 20% price reduction in Fairtrade; and 3) A moral appeal to customers to buy Fairtrade coffee and alleviate poverty in developing countries. It examined actual ethical purchase behavior complemented with a customer survey, contrasting observed ethical buying behavior with self-reported Fairtrade consumption. The results suggest that only the price reduction had the expected positive and statistically significant effect on Fairtrade coffee consumption. (Andorfer and Liebe, 2015)[3]

The study was performed only in one market in Germany and should be viewed in that scale, yet the results reveal an irony whereas the respondent's trust that Fairtrade organizations distribute the money to small-scale producers and a feeling of moral obligation to purchase Fairtrade products have a positive effect on the self-reported Fairtrade consumption and whereas, the belief that Fairtrade products are too expensive have a negative effect on purchasing. The study's finding that Fairtrade purchases increased when prices were reduced by 20%, highlights the consumer's economic constraints in ethical consumption, according to the authors. The models show that self-reported Fairtrade consumption is significantly affected by customer's trust in Fairtrade, price perception, and moral obligation to purchase Fairtrade coffee.

Consumers cannot readily ascertain production standards, lack knowledge about ethically sourced labels in general, and find it hard to distinguish these products from other labeled goods

such as organic or environmentally friendly produce. In addition, consumers are confused by different ethical labels, certifications and the plethora of organizations involved in the ethical sourcing market.[4] These problems can also be conceptualized as market-based information failure.[5] Several studies suggest that the demand for coffee is highly elastic with average elasticities around -7[6], meaning that customers readily substitute between coffee brands when prices change and that consumers are not loyal to one ethically sourced certification over another.

For example, a consumer aiming to purchase ethically-sourced products would not readily distinguish the difference between a Fairtrade certification and a private label certification. Academic studies have analyzed different outcomes across varying certifications and geographies. For example, a comparative analysis of different types of certified farmers in Northern Nicaragua finds that Fairtrade provides better prices but private labels support higher yield and better quality performance, indicating that the Fairtrade certification can be helpful to support initial market incorporation, whereas private labels offer suitable incentives for subsequent quality upgrading. [7] Consumers do not distinguish between these differences.

Despite the lack of consumer ability to distinguish between ethical certifications, research by the advertising firm, Barkely, has demonstrated that 50% of Millennials (born 1980-2000) make an effort to buy from companies that support causes they care about and 40% of Millennials can be segmented in the populations whose main identifying purchase decisions align with the following: either "I can make the world a better place" or "I can take care of myself and the world around me.[8] Millennials currently have a $200 billion purchasing power in the U.S. alone according to the Barkely study.

Not only do consumers lack the ability to distinguish certifications, the alphabet soup of certification and verification programs likewise can muddy perception, particularly at the coffee farmer level. Exporting companies often must manage a variety of different certification/verification requirements in response to demands from different coffee roasting companies regarding the certification/verification that they prefer for their markets. Despite operating as different companies, the vast majority of the certifications/verifications maintain the same objective, which is to guarantee that farmers and farming communities are treated

equitably, to limit environmental degradation and to ensure economic accountability throughout the supply chain.

As the discernibility of certifications/verifications are dismal both at the consumer and producer levels, the coffee industry sits at an opportune moment to analyze the key sustainability and economic accountability indicators that would benefit the entire supply chain through the availability of real-time information. Many current studies call for further research into integrating demand for sustainable consumption and sustainable supply chains and in fact, an industry initiative, the Sustainable Coffee Challenge, seeks both to stimulate demand for sustainable coffee at the consumer level and coalesce the industry around sustainability metrics. As stated in a 2015 study analyzing the challenges of developing data architecture for the integration of sustainable supply chains (Sayogo and Zhang):

> *"Managing sustainability across the whole supply chain underscores the need for supply chain partners to understand each other's capabilities to collaborate with each other as well as share information about their sustainable practices. As such, information systems, technologies and information integration constitute key drivers in enabling the integration of sustainable consumption and sustainable supply chains. Sharing information becomes especially important with the increasing demand for accurate, timely and traceable information about the sustainability of companies' products and practices."*[9]

The Sayogo and Zhang study highlights that the current literature on sustainable coffee, ethical certifications and supply chain transparency call for further research into integrating sustainable consumption and sustainable supply chains. The study points out, "Such integration requires information sharing and traceability to reduce information asymmetry across the supply chain. However, current research has mostly investigated these issues independently. The growing body of scholarship tends to separate consumption from production."[10]

Although this study does not ostensibly tie sustainable production with sustainable consumption, the analysis is performed through a lens at the producer, exporter, roaster levels, examining how coffee roasting companies can influence the supply chain to have a positive, equitable impact on coffee farmers, while also delivering coffee to consumers with transparent claims that are backed up with real time data on sustainability indicators.

V. Methodology

The study utilized data drawn from 340 supply chains that were audited by a third-party verifier assessing the supply chains in accordance with one verification standard, that will remain anonymous due to confidentiality agreements. Each supply chain represents the following audited entities: coffee farmer, wet mill, dry mill and exporter. The audit information and data is then uploaded by the third party verifier to a third party database system that the coffee company can access, ensuring integrity at the supply chain and company level.

The data in this study was collected and cleaned by the author from the third party database and represents 341 supply chains that have a capacity of approximately 1.225 billion pounds of green Arabica coffee or 9.2 million bags of green Arabica coffee in the industry standard measurement. In context, the world green Arabica coffee in 2015 was 82.9 million bags, according to the International Coffee Association[11]. Therefore 11% of the world's green Arabica coffee production in 2015 was evaluated by this verification.

As the data is representative of 11% of the entire green Arabica coffee production, it may be analyzed at two levels—both as a population study and as a representative sample that can inform broader assumptions at a global Arabica coffee production level. This study will primarily focus on the statistical population study and make recommendations with regard to the specific verification program and utilize the data as representative sample in the recommendations, as it captures 11% of the global Arabica coffee production.

This study's goal is to analyze two scores within the verification standard, Producer Support and Economic Accountability to determine if there is a statistical correlation. In order to compare whether or not Producer Support scores have the largest impact on Economic Accountability, the Social Responsibility score was also analyzed to determine whether or not a statistical relationship existed between Social Responsibility and Economic Accountability. All supply chains are scored through a third party audit completed in coordination with the exporter of the supply chain. The wet mills, dry mills and farmers are audited as well and their scores are comprised within the overall score. The criteria comprise the following information:

Economic Accountability (EA): Demonstration of financial transparency in record keeping at farmer, mill and export level.

Producer Support (PS): Comprises the support and training that the exporting company provides to coffee farmers and cooperatives including management and tracking systems, hiring practices, controlling soil erosion, maintaining soil productivity, maintaining shade canopy, protecting wildlife and conservation, ecological pest and disease control, and management and monitoring.

Social Responsibility (SR): Comprises wages and benefits of workers, hours of work, child labor, access to housing, water and sanitation facilities, access to education, worker safety and training, transparency in operations and policies.

From the analysis of the variance and coefficient correlation between the Producer Support score as the independent variable and Economic Accountability as the dependent variable, the P-Value was then used to determine if changes in the independent variable (PS) are related to changes in the dependent variable (EA). The Pearson Correlation was utilized to determine the strength of the linear relationship. A simple regression analysis was utilized to determine the linear model for the relation between Producer Support and Economic Accountability. The model summary analyzing the R^2 value (coefficient of determination) was utilized to gauge how close the data is fitted to the regression line. In order to check bias, the residual versus fit plot were also analyzed.

Three different scores comprise the Economic Accountability overall score including: scores at the farm, wet mill and dry mill levels. In order to determine if one of these scores had a greater correlation with Producer Support scores, the three Economic Accountability scores were analyzed separately against the Producer Support scores using the same model as above.

In addition, to further analyze the range of the Producer Support score impact on the Economic Accountability score, a histogram was developed to show the percentage of Economic Accountability scores at 100% per Producer Support range scores by 5% intervals. This representation also sought to determine if there was a Producer Support score that 90% of the time would give a 100% Economic Accountability Score.

The coefficient and Pearson correlation was analyzed to determine the relationship between Social Responsibility indicators as the independent variable and Economic Accountability as the dependent variable.

VI. Results Overview

A. Producer Support (Independent Variable) and Economic Accountability (Dependent Variable)

Tables 1-9 analyze the Producer Support scores as the independent variable and the Economic Accountability scores, as the dependent variable, drawing data from 340 coffee supply chains that were independently verified by a third party verification organization. The Economic Accountability scores are aggregated and averaged from three separately measured Economic Accountability scores at the farm (producer), wet mill and dry mill levels. The farm level is comprised of over 80% smallholder farmers and are therefore primarily representative of individual households. The remaining represent medium to large sized farms.

Table 1 displays that 168 of the 340 supply chains (49%) received 100% Economic Accountability score, while 118 (35%) scored below 85%. 50 supply chains (15% of population) scored below 50%.

Table 1

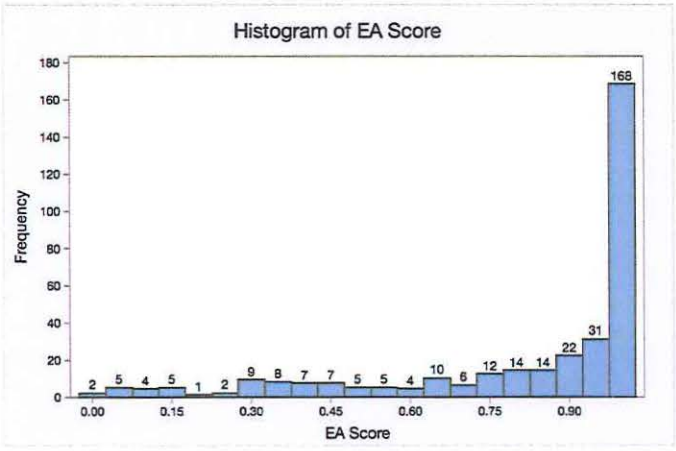


Table 2 demonstrates the percentage of Economic Accountability scores at 100% per Producer Support range scores by 5% intervals. Of the supply chains who achieved a 100% Producer Support score, 74% received 100% Economic Accountability scores. Therefore, the intended analysis to find the Producer Support score where 90% of the supply chains possess a 100% Economic Accountability score does not exist.

Table 2

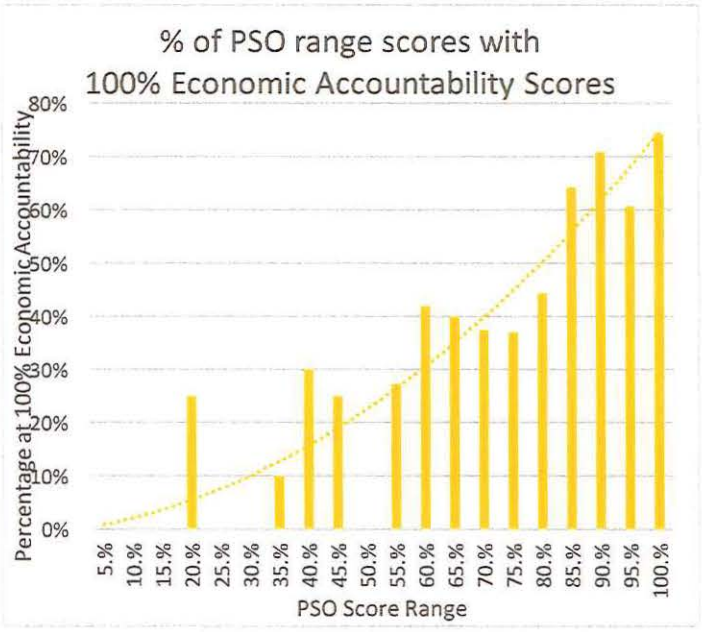


Table 3 shows the mean of the Economic Accountability scores to be 82%, while the Producer Support mean stands lower at 71%.

Table 3

Statistics

Variable	N	N *	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
PSO Score	341	0	0.71358	0.01107	0.20451	0.10000	0.60000	0.75000	0.87500	1.00000
EA Score	341	0	0.82381	0.01429	0.26394	0.00000	0.75000	0.97000	1.00000	1.00000

In order to determine if the relation between Producer Support scores and Economic Accountability scores is statistically significant, the coefficients of the relationship were first analyzed, detailed in Table 4. A linear regression proved to be an appropriate analytical tool as the p-value was <0.0001 and the Pearson Correlation in Table 5 demonstrates a positive correlated relationship, sitting squarely between a perfect linear relationship (score of 1.0) and absence of a linear relationship (0.0)

Table 4

Coefficients

Term	Coef	SE Coef	T-Value	P-Value
Constant	0.34631	0.04449	7.78	<0.0001
PSO Score	0.66916	0.05994	11.16	<0.0001

Table 5

Correlation

Pearson correlation of PSO Score and EA Score = 0.518501
P-Value = <0.0001

Table 6 shows a linear correlation demonstrating that as Producer Support scores increase, the trend line of Economic Accountability scores also increase with a regression equation of: EA= 0.34631 + 0.66916 PS Score. Table 8 demonstrates a R^2 value of 26.88% showing that despite a statistically significant trend, there is high data variability. The predictor variable still provides a trend about the response variable, yet there are data points that fall further away from the regression line.

Table 6

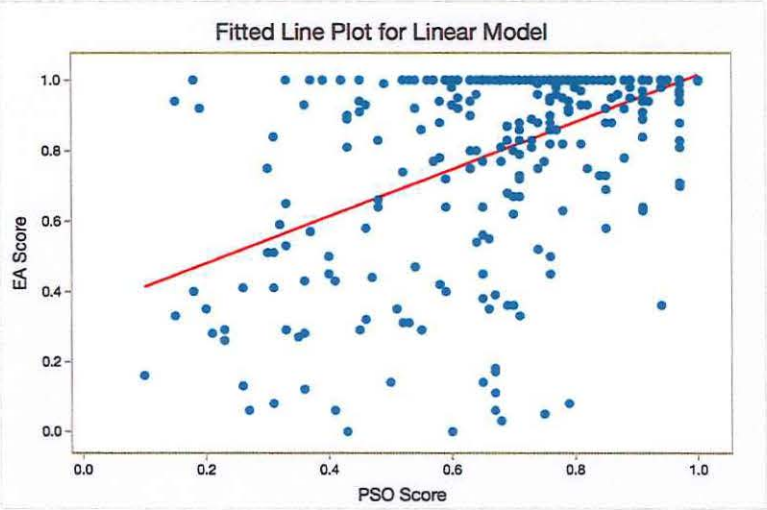


Table 7

Regression Equation

EA Score = 0.34631 + 0.66916 PSO Score

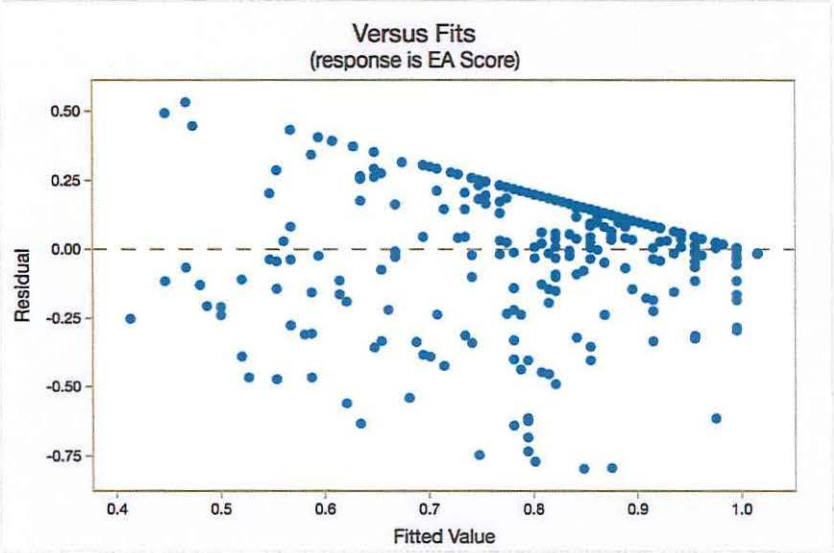
Table 8

Model Summary

S	R-sq	R-sq(adj)
0.226021	26.88%	26.67%

A residual plot was created in Table 9 due to the variability demonstrated in Table 8 in order to determine if the residuals have constant variance. There is constant variance with a large set of the data, though there is a trend detected with a portion of the data at the top of the first quadrant.

Table 9



B. Producer Support (Independent Variable) and Economic Accountability-Farmer (Dependent Variable)

Tables 10 through 16 analyze segregated Economic Accountability scores from smallholder farmers and do not include scores from the wet and dry mills. Comparison between the EA Farmer mean and the Overall EA mean show similarity with 84% and 82%, respectively. The descriptive statistics do not appear to significantly different, and a simple regression was selected for analysis again as the coefficients as the p-value was <0.0001 and Pearson Correlation was slightly higher at 0.57 in Tables 11 and 12.

Table 10

Statistics

Variable	N	N *	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
PSO Score	341	0	0.71358	0.01107	0.20451	0.10000	0.60000	0.75000	0.87500	1.00000
EA Farms	341	0	0.81073	0.01524	0.28146	0.00000	0.73000	0.97000	1.00000	1.00000

Table 11

Coefficients

Term	Coef	SE Coef	T-Value	P-Value
Constant	0.29336	0.04716	6.22	<0.0001
PSO Score	0.72505	0.06353	11.41	<0.0001

Table 12

Correlation

Pearson correlation of PSO Score and EA Farms = 0.526824
P-Value = <0.0001

The regression in Table 13 demonstrates that as Producer Support scores increase, the trend line of Economic Accountability scores also increase with a regression equation of EA Farms = 0.36362 + 0.67043 PSO Score and a slightly higher R-sq model summary at 33% demonstrated in Table 14 and Table 15.

Table 13

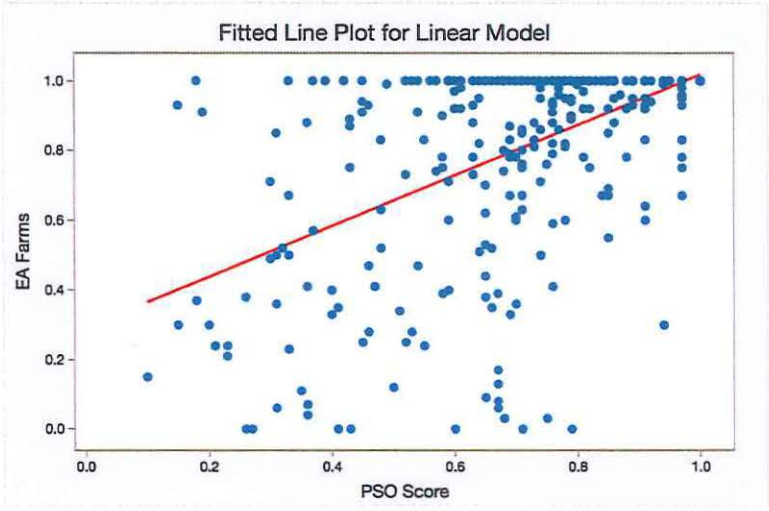


Table 14

Regression Equation

EA Farms = 0.29336 + 0.72505 PSO Score

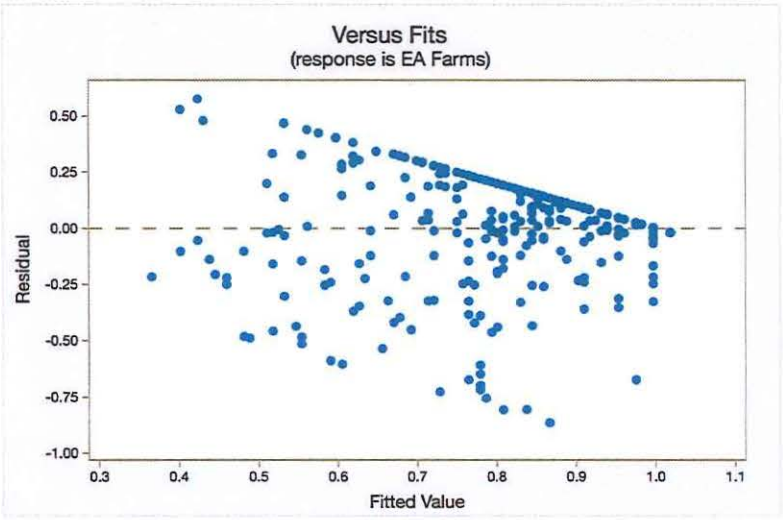
Table 15

Model Summary

S	R-sq	R-sq(adj)
0.239588	27.75%	27.54%

A residual plot was created in Table 16 due to the variability demonstrated in Table 13 in order to determine if the residuals have constant variance. There is constant variance with a large set of the data, though there is a trend detected with a portion of the data, explaining the lower R^2 score, demonstrating correlation, but not a foolproof model.

Table 16



C. Producer Support (Independent Variable) and Economic Accountability-Wet Mill (Dependent Variable)

Economic Accountability scores at the wet mill were segregated from overall Economic Accountability scores. The coefficients and correlation were not as strong as the comparison between Economic Accountability at the farmer level and PSO score. The coefficients demonstrated a P-value of <0.0001 in Table 18, yet when analyzed with the Pearson Correlation in Table 19, the P-value was 0.0013 and the correlation decreased to 0.24 from 0.57 in the comparison between EA at farm level. A regression was run and detected a lesser liner correlation. The R^2 score of 5.4% demonstrates that this is not a model for predicting Economic Accountability.

Table 17

Statistics

Variable	N	N *	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
PSO Score	170	0	0.7052	0.0164	0.2138	0.10000	0.5875	0.7600	0.8650	1.00000
EA Wet Mills	170	0	0.9254	0.0134	0.1758	0.00000	1.0000	1.0000	1.0000	1.00000

Table 18

Coefficients

Term	Coef	SE Coef	T-Value	P-Value
Constant	0.78356	0.04531	17.29	<0.0001
PSO Score	0.20112	0.06150	3.27	0.0013

Table 19

Correlation

Pearson correlation of PSO Score and EA Wet Mills = 0.244648
P-Value = 0.0013

Table 20

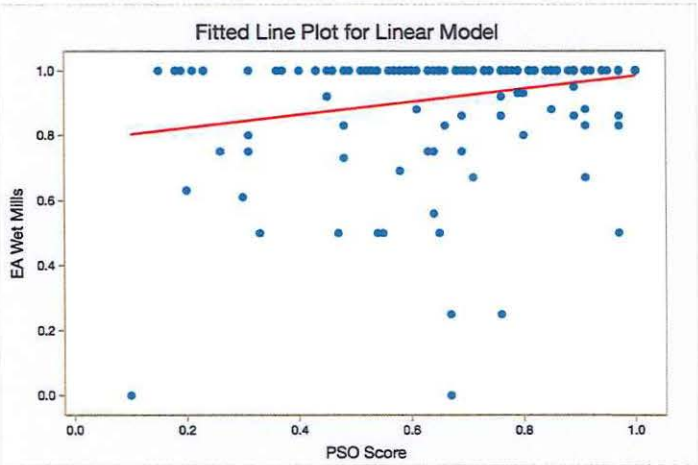


Table 21

Regression Equation

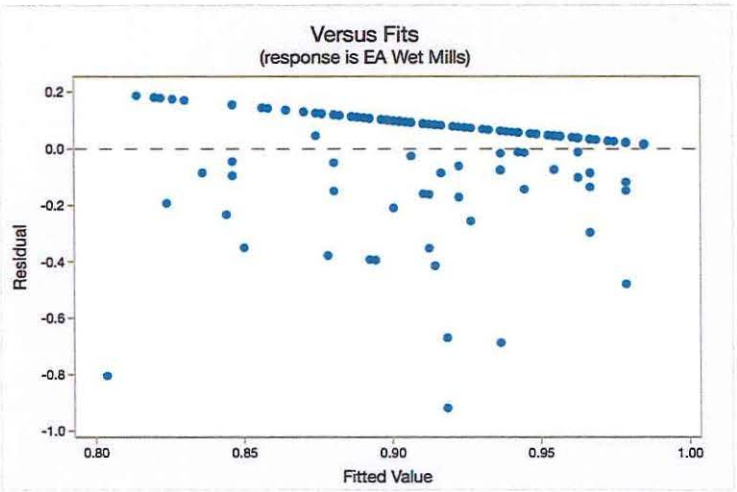
EA Wet Mills = 0.78356 + 0.20112 PSO Score

Table 22

Model Summary

S	R-sq	R-sq(adj)
0.170964	5.99%	5.43%

Table 23



D. Producer Support (Independent Variable) and Economic Accountability-Dry Mill (Dependent Variable)

A regression analysis was not utilized when isolating the EA scores at the dry mill level as the P-value was 0.8 and the Pearson Correlation was 0.014, demonstrating there is not a statistical relationship between EA at the dry mill level and PSO scores.

Table 24

Statistics

Variable	N	N *	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
PSO Score	21	0	0.6986	0.0148	0.2154	0.1000	0.590	0.740	0.860	1.0000
	1		7	3	8	0	00	00	00	0
EA Dry Mills	21	0	0.9875	0.0063	0.0922	0.0000	1.000	1.000	1.000	1.0000
	1		36	48	14	00	00	00	00	0

Table 25

Coefficients

Term	Coef	SE Coef	T-Value	P-Value
Constant	0.97508	0.02162	45.10	<0.0001
PSO Score	0.01783	0.02958	0.60	0.5474

Table 26

Correlation

Pearson correlation of PSO Score and EA Dry Mills = 0.041654
P-Value = 0.5474

E. Social Responsibility (Independent Variable) and Economic Accountability (Dependent Variable)

Tables 27-29 analyze Social Responsibility scores as the predictor and Economic Accountability scores as the reaction in order to benchmark the prior analysis of Producer Support as the predictor and Economic Accountability as the reaction. In Table 29, the Pearson Correlation rests near zero indicating the absence of a linear relationship, while the P-Value does not demonstrate a correlated relationship.

Table 27

Statistics

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
EA Score	34	0	0.8238	0.0142	0.2639	0.00000	0.7500	0.9700	1.0000	1.00000
	1		1	9	4		0	0	0	
SR Score	34	0	0.8946	0.0036	0.0665	0.49000	0.8600	0.9000	0.9400	1.00000
	1		04	03	42	0	00	00	00	

Table 28

Coefficients

Term	Coef	SE Coef	T-Value	P-Value
Constant	0.7756	0.1932	4.01	<0.0001
SR Score	0.0539	0.2154	0.25	0.8024

Table 29

Correlation

Pearson correlation of SR Score and EA Score = 0.013601
P-Value = 0.8024

VII. Discussion of Results

The Economic Accountability indicators detail whether or not the audited entity (farmer, wet mill and dry mill) have kept documentation of coffee sales including purchase date, buyer and seller names, the unit of measure, the price per unit, the quantity and the type of coffee (cherry, parchment or green).

49% of the audited supply chains were able to maintain 95%-100% compliance at the farmer, wet mill and dry mill level, indicating that there are missing transactional records in 51% of the audited supply chains. The Economic Accountability mean score is 82% across the 340 supply chains.

Breaking down the aggregate Economic Accountability scores and isolating the farmer, wet mill and dry mills scores, it is apparent that the farmer scores account for lowering the overall Economic Accountability score. The mean EA score at the farm level is 81%, while the mean EA score at the wet mill is 93% and the mean EA score at the dry mill level is 99%. This data is predictable as the dry mill is often responsible for export and must provide this information to finalize a sales contract. The mean score of 81% at the farm level indicates that farmers provide only some of the information required by the Economic Accountability criteria and that a portion of the sales records are consistently missing.

The breakdown of scores between entities is critical as the demonstration of financial transparency is only objective and accurate if records between the entities can be compared. This is not a stipulation under the Economic Accountability criteria and currently would not be possible in 49% of supply chains due to missing information, primarily at the farmer level.

Producer Support scores gauge the level of support that the exporting company or cooperative provides to the farmer either directly or through a third party capacity building organization. The support level is scored through the following criteria: management and tracking systems, hiring practices, controlling surface erosion, maintaining soil productivity, maintaining shade canopy, protecting wildlife and conservation areas, pest and disease control, management and monitoring and climate change.

The regression analysis demonstrates that the Producer Support scores have a statistically relevant influence on the Economic Accountability scores. The Pearson correlation shows a medium to large positive correlation; when the Producer Support scores increase, Economic Accountability scores increase. A possible explanation for any variance may relate to the fact that a portion of the Producer Support criteria focuses on management, tracking systems and monitoring, while other criteria focus on conservation and soil. Despite demonstrating a linear relationship, the regression model only describes 27% of the variability, likewise pointing to the variety of indicators between management and environment within the Producer Support score.

The positive correlation also demonstrates itself through the increase in the number of 100% Economic Accountability scores associated to an increase in Producer Support scores. Two conclusions can be drawn from this association. First, the concept of Producer Support has created a positive impact on Economic Accountability scores and can continue to be used as a lever to increase Economic Accountability. Secondly, the range scores demonstrate that among the supply chains that secure a 100% Producer Support score, 74% of those supply chains scored a 100% Economic Accountability rating. This data implies that 26% of the supply chains who scored a perfect 100% in Producer Support do not have farmer uptake in record keeping, indicating that there is significant opportunity for refining Producer Support to ensure that farmers keep accurate sales records.

The Social Responsibility criteria was also analyzed to determine if the scores have a statistically significant effect on the Economic Accountability scores. Social Responsibility criteria include: wages and benefits, work hours, child labor, access to housing, water and sanitary facilities, access to education, worker safety and training and labor management systems. The Social Responsibility scores were found to have no statistical correlation with the Economic Accountability scores. The criteria corresponding to wages, works hours and child labor often are only applicable to large farms that have more sophisticated bookkeeping systems than smallholder farms and therefore do not have influencing correlation with the Economic Accountability indicators as they are currently written.

VIII. Conclusion

Ultimately the goal of the vast majority of coffee ethical certification/verification programs is to ensure the just and fair payment and treatment of farmers across the world and to safeguard a sustainable future supply of coffee. This study aimed to analyze the effectiveness of the Economic Accountability standards in one certification/verification program and whether or not there was a statistical correlation between Producer Support scores and Economic Accountability scores. 340 coffee supply chains were analyzed in one certification program, accounting for 11% of the global supply of Arabica coffee, and it was found that there are missing sales transactional records in 51% of the supply chains, primarily at the farmer level. The study also found that there is a statistical positive correlation between the Producer Support certification criteria and the Economic Accountability criteria, indicating that that the stronger the Producer Support scores, the more likely farmers are to maintain sales records.

To objectively verify if coffee farmers have been paid in a just and timely manner, farmers must keep valid records that can be cross checked with wet mill and dry mill records. Currently, the Economic Accountability indicators only track whether each entity separately keeps records. In order to verify Economic Accountability, these records should be cross referenced in the certification audit for price transparency. This study has shown that there is a statistical positive correlation between higher Producer Support scores influencing higher Economic Accountability

scores and therefore the end buyer, the coffee roaster, should emphasize the need for improving Producer Support scores, particularly in management, tracking systems and monitoring. The average Producer Support score of the 340supply chains currently rests at 71%, leaving significant opportunity for improvement.

This study analyzed only one certification/verification program, though there continues to be a proliferation of different ethical sourcing certifications including Fair Trade (FLO), Fair Trade USA, Fair for Life, C.A.F.E. Practices, Rainforest Alliance, UTZ, among others. Each program requires similar social and environmental criteria, yet with different indicators and varying cost structures. Therefore, if a smallholder coffee farmer (through a cooperative or exporter) sells to several coffee roasters who require differing certifications, the farmer is saddled with compliance to hundreds of varying indicators between certifications, with no guarantee that their coffee will be sold at the premium price provided by the certification. Certifications can be a market impediment for smallholder famers and a deterrent to follow best practices if the indicators are strictly followed, but not rewarded with premium prices. Further research into the current marketplace of ethical certifications and the consolidation of a premium trade structure could benefit the entire industry to ensure economic transparency and crop sustainability.

IX. Recommendations

A. The Economic Accountability indicators can be strengthened by requiring a cross check of sales records between the farmer, wet mill and dry mill to ensure alignment during the audit.

B. The Producer Support scores show there is opportunity for growth. This study shows that this growth is proven to have a positive impact on farmers maintaining sales records. The coffee roaster should emphasize the importance of raising these scores with the supplier and create accountability through either the carrot or the stick approach, as deemed appropriate. A specific focus should be placed on improving the management, tracking and monitoring indicators in the Producer Support criteria, while providing farmers with simple business tools and mobile solutions to ensure coffee sales records are kept.

C. The certification program currently traces the coffee through individual farmer ID numbers, wet mill ID numbers and dry mill ID numbers. The certification system IT architecture could be improved so that price and quality down to the farmer level is trackable and readily accessible to buyers (traders) for purchasing decisions. Farmers could be provided with a simple mobile solution for payment, sales record keeping and quality connected to the certification server that end buyer and auditor could access to ensure payment transparency and timeliness down to the farmer level.

D. Certification programs ultimately cost farmers time and money and may provide a return on investment but also carry an inherent risk that the investment may go unrewarded due to a lack of buyers willing to pay the premium for that particular certification. The industry could benefit from further analysis of the consolidation of certain certifications, while strictly retaining the highest standards regarding economic accountability and sustainability of the coffee supply.

End Notes

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