Changing Lives in Kenya: The Impact of the Zoe Empowers Model

by Kenneth Hinze, PhD. Sociologist/Demographer, September, 2020

Executive Summary

Introduction. This report provides a rigorous and independent assessment of the Zoe Empowers model (zoeempowers.org). Zoe Empowers strives to ameliorate extreme poverty among orphans and vulnerable children in several sub-Saharan African countries plus India. Zoe supports empowerment through a holistic three-year graduation program. The data for this report come from the 2018-2019 Zoe Survey cycle in Kenya.

A Present and Past-Tense Self-Sufficiency Index (The Dependent Variable). The Zoe target is full self-sufficiency for each of these child-led households. We measure self-sufficiency as an index (the 4qSSI) based on the household head's answers to four questions: number of meals eaten per day, eat enough to be satisfied, adequacy of housing, and sufficient income for household necessities. 4qSSI is an interval scale (from 0 to 3) best characterized as near 0 denotes EXTREMELY VULNERABLE, near 1 means VULNERABLE, near 2 means SELF-SUSTAINING, and near 3 denotes FLOURISHING. By this measure none of the Incoming, 90 percent of the Midpoint, and 100 percent of Zoe Graduating households had become self-sustaining. By graduation every household succeeded. No one was left behind!

Comparing Different Zoe Households (Cross-Sectional Analysis). One way to estimate program impact is to compare the 4qSSI scores of Incoming, Midpoint, and Graduate households. By this measure the first-half impact is **1.85** (difference between average Incoming and Midpoint 4qSSI) and the second-half impact is **0.45** (difference between average Midpoint and Graduate 4qSSI).

However, cross-sectional analysis can be misleading. Cross-sectional data cannot detect cause-and-effect. First, we are not really measuring change in anyone, just comparing different households. Additionally, we cannot show proper time-order, that is, the cause has to happen before the result. Finally, cross-sectional data cannot separate Zoe program impact from other confounding factors, known and unknown (for example, maybe the Graduates were smarter all along).

Comparing Zoe Households with Themselves (Panel Analysis). Using panel analysis we follow people through time and measure change in actual households. We are not comparing households with other households. We are comparing households with themselves at earlier and later times. That means we have filtered out all of the known and unknown time-stable characteristics of these households (such as intelligence) as explanations of 4qSSI. Our panel analysis estimate of second-half program impact is **0.45**, nearly the same as the cross-sectional estimate **0.48**. Using either estimate, most Zoe households move from self-sustaining at Midpoint to nearly flourishing at Graduation.

However, because there is no control group, we cannot know what would have happened to Zoe participants if their participation had ended at Midpoint. A counterfactual "control" group is a critical part of rigorously assessing program impact.

Comparing Change in Zoe Households with Change in Non-Zoe Households (Quasi-Experiments). An adequate comparison or "control" group is the final piece of a rigorous assessment of Zoe program impact. The logic of quasi-experiments if this: If Zoe participants are exactly the same as nonparticipants in every way except Zoe program participation, then the differences in their later outcomes are due to program participation alone. We then simply compare change in the participants with change in the nonparticipants. Our quasi-experiment estimate of first-half program impact is **1.73**, similar to the cross-sectional estimate **1.85**. Using either estimate, most Zoe households move from very vulnerable at Incoming to self-sustaining at Midpoint.

All these estimates point to the same conclusion, *a three-year Kenya Zoe program impact of 2.3.* Add this estimate to the average Incoming 4qSSI (0.43), and the sum is 2.7, the actual average for Graduating Kenyan Zoe participants. *That means rising from grave vulnerability to holistic near flourishing in thirty-six months however we assess!*

The Heart of the Zoe Empowers Model (Path Analysis). How does the Zoe Empowers Model achieve these results? Path analysis says the Zoe Empowers model is remarkably effective because it simultaneously, intentionally, and equally addresses foundational human needs – both the "social support" and the "income" varieties of basic human needs.

Section 1. Introduction

This report provides a rigorous and independent assessment of the Zoe Empowers model (zoeempowers.org). Zoe Empowers strives to ameliorate extreme poverty among orphans and vulnerable children in several sub-Saharan African countries plus India. Zoe supports empowerment through a holistic three-year graduation program (Warner, pages 80-81).

The data for this report come from the 2018-2019 Zoe Survey cycle in Kenya. Respondents were cluster-sampled to represent adequately Incoming, Midpoint, and Graduate Empowerment Groups in the three-year program. Zoe Empowerment Groups are the core of the Zoe model and usually include about thirty households. These households are youth-led and child-led families composed of orphans and other deeply vulnerable children.

The seventy-six question questionnaire was administered by Zoe staff in regular group meetings, supplemented by in-home visits when required. Zoe staff and we believe the responses adequately describe the circumstances of the Zoe children as they themselves see things.

The Zoe research design has these three following components:

(1) a cross-sectional survey to compare many <u>different households</u> at the same time,

(2) a panel analysis to assess the self-sufficiency of the <u>same households through time</u>, and

(3) quasi-experimental analyses to compare Zoe participants (the treatment group) with non-participants (the comparison group).

Additionally, we have included a "path analysis" to explore the heart of the Zoe model.

In this report, we are using advanced statistical techniques to reduce about 225,000 cells of data into just a few numbers that can accurately measure and explain Zoe program impact in Kenya.

Our hope is that honest and accurate assessment of answers directly from the children can give staff and donors (old and new) a clear sense that their efforts are working because the Zoe model is working.

Section 2. A Present and Past-Tense Self-Sufficiency Index (The Dependent Variable)

First, we need to measure the target outcome for the Zoe program. This Zoe target is full self-sufficiency for each of these child-led families. So, we need to identify how to measure self-sufficiency.

Over the years Zoe staff (with the assistance of SAS, Inc.) has developed an excellent seventy-four-item index called the Self-Sufficiency Index (SSI). The SSI has proven very useful for several years in the various Zoe countries. The SSI is an interval scale (from 0 to 3) best characterized as

near 0 denotes EXTREMELY VULNERABLE,
near 1 means VULNERABLE,
near 2 means SELF-SUSTAINING, and
near 3 denotes FLOURISHING.

Figure 1 summarizes the SSI for the young Zoe households in Kenya. Kristin McGee, Zoe Program Data Manager, created this graph and also authored most of the Zoe questionnaire. At a glance, we can see the SSI for the eight competence areas that the Zoe model addresses. Please notice the SSI average is low among Incoming households, 2.19 or better among Midpoint households, and 2.46 to 2.84 for Graduate households. Very impressive differences! The purpose of this report is to answer the question, "Did participation in the Zoe Empowers Program cause these differences?"

Most important, for this report we can use a smaller SSI that also has a past-tense, "twelve months ago," recalled version. It is based on four questions, and we call it the 4qSSI. These four questions have been asked in some form since early 2018. So, they allow us to measure SSI as recalled back to the beginning of 2017 for many households.

Table 1 shows the four questions and the scoring system for the 4qSSI. (Each question also has a recalled or past-tense version that says, for example, "Twelve months ago, I lived in an adequate/safe home.") If a household head answered the "3" choice for each question, their 4qSSI was 3.00. Thirty-eight percent of Graduate households answered the "3" choice for all four questions. We call that "flourishing." If a household head answered the "0" choice for each question, their 4qSSI was 0.00. We call that "extremely vulnerable." Please look at the questions and the zero answers. To be sure,

4qSSI = 0.00 describes a very marginal, dangerous existence for that household. Sadly, many of Kenyan Incoming households (15%) answered all zeros. By their responses to straightforward questions, they are telling us directly their lives are "extremely vulnerable."

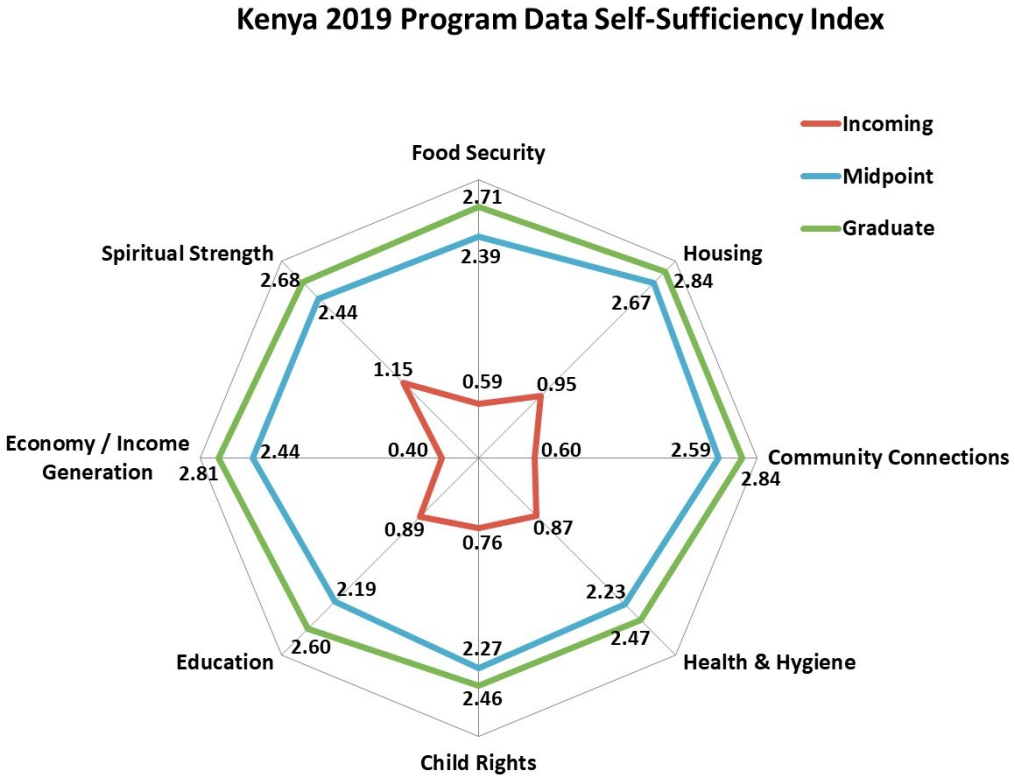

Figure 1: Components of the Total Self-Sufficiency Index

For our purposes 4qSSI=2.00 is the most important level because it signals self-sustainability for the household. This is the primary purpose of the Zoe program. By this measure none of the Incoming, 90 percent of the Midpoint, and 100 percent of Zoe Graduating households had achieved self-sustainability. By graduation every household succeeded. No one was left behind!

The 4qSSI scoring system makes the index easy to interpret. E*ach time a young household head answers one question one level higher, the index goes up .25.* Since the average Incoming 4qSSI was .43, we know new households usually answered two questions as "1" and the other two questions "0". Many of these families inherited some property from their parents, so 4qSSI = .43 usually means their housing was not the worst, but they were not eating enough and had little or no income.

This 4qSSI is directly comparable to the seventy-four-item (total) SSI. Like the total SSI, the 4qSSI is an interval scale (from 0 to 3) best characterized as
near 0 denotes EXTREMELY VULNERABLE, near 1 denotes VULNERABLE,
near 2 denotes SELF-SUSTAINING, and near 3 denotes FLOURISHING.

Table 1. The Questions Comprising the 4-Question Self-Sufficiency Index (4qSSI)

Questions and Summary Interpretations	0	1	2	3
1. Current number of meals (food serving of any type) eaten per day, on average.	often none	1 meal	2 meals	3 if I want
2. I eat enough food each day so that I am satisfied.	never	seldom	usually	always
3. I live in an adequate/safe home.	strongly disagree	disagree	agree	strongly agree
4. Through my work, I can provide sufficient food, clothing, school expenses, and other necessities for my household.	strongly disagree	disagree	agree	strongly agree
Summary Interpretations	Extremely Vulnerable	Vulnerable	Self-Sustaining	Flourishing

Scoring system: Sum the answers and divide by four.

Figure 2 shows that the 4qSSI works really well. This is a scatterplot of the 1,599 household surveys, arranged with the 4qSSI on the horizontal axis and the total SSI on the vertical axis. Both indexes range from 0 to 3. They are practically perfectly correlated (r = .973). This chart shows the 4qSSI is a wonderful stand-in for the more thorough total SSI of seventy-four questions and gives us a retrospective measure as well. We will put this to good use in the rest of this report. By the way, the scatterplot dots happen to be Incoming households on the lower left and Midpoint and Graduate households in the middle and upper right. The Incoming households live a very different, very vulnerable existence.

However, at very low levels, the 4qSSI is often lower than the total SSI. This happens because three of the four questions (75%) are very hard for extremely poor people. In the total SSI, only half of the questions have that character. So the 4qSSI should give a more sensitive, insightful understanding of the impact of the Zoe program in the early months.

In summary, the 4qSSI gives us the information we need to assess rigorously the impact of the Zoe Empowers model.

Table 2 is the major organizing table for this entire report. Table 2 organizes all the summarizing self-sufficiency information we have for each Kenyan cohort through time. Here we can see the cross-sectional comparisons of average SSI (total SSI and 4qSSI), track the panels through time, and locate the comparable treatment and comparison groups.

Briefly, let us identify the panels available to us. A panel is the same households surveyed at different time points. Cohort 4 is one panel, measured at about six, eighteen, twenty-four, and thirty-six months

into the program. They will give us our best evidence about the second half of the three-year Zoe program. We analyze the experience of this panel in Section 4 of this report, Panel Analysis.

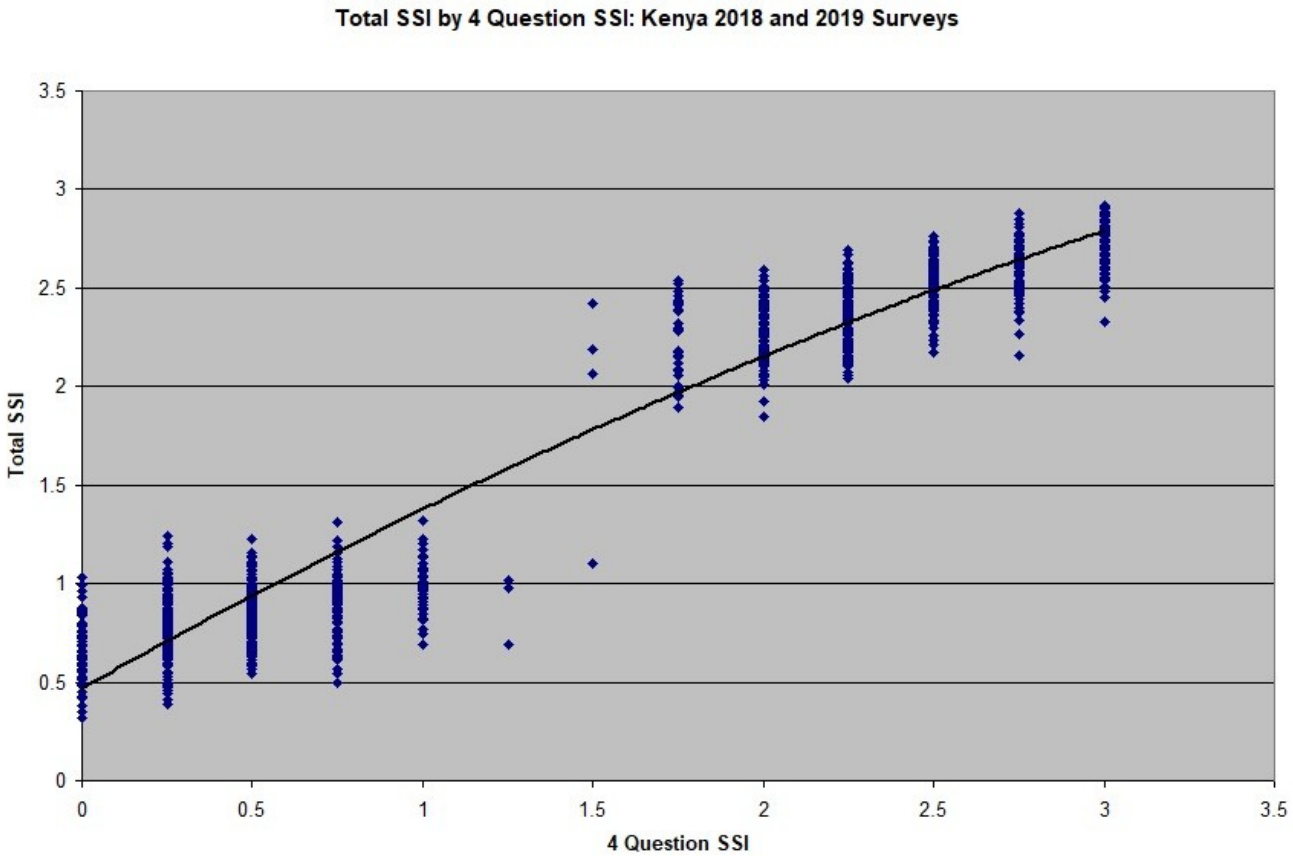

Figure 2: Correlation between the Total SSI and the 4qSSI

Cohort 6 in Table 2 is another panel available to us and is our most important one. Cohort 6 is 240 households measured one year before Zoe and at month zero (before Zoe) and at six and eighteen months after program initiation. Cohort 6 is our most important panel for two reasons. First, we can compare Cohort 6 households with themselves before and after Zoe participation. Please notice that these households on average were going down (.67 to .51) before Zoe and then up sharply (to .88 and 2.21) after entering the program. Second, we can compare Cohort 6 households as a treatment group with Cohort 8 as a comparison group. We can do this comparison because Cohort 6 took their Midpoint survey in the last half of 2019, while Cohort 8 also took their Incoming survey in the last half of 2019. And Cohort 8 may serve as a comparison or "control" group, because they answered 4qSSI questions for their year before entering Zoe when they were non-participants. Finally, Cohort 7 may serve as a comparison group to Cohort 5.

We analyze the experience of these treatment and comparison groups in Section 5 of this report, Quasi-Experiments.

Table 2. Average SSI for Cohorts of Sampled ZOE Households:
Kenya, Surveyed 2018 and 2019

	Months in ZOE					
Cohort/Survey Dates	-12	**0**	6	**18**	24	**36**
1. Ken 2015 N=202						
2/2018						
Total SSI						2.56
4 question SSI					1.63	2.63
2. Ken 2016-C1 N=154						
12/2018						
Total SSI						2.68
4 question SSI					1.89	2.86
3. Ken 2016-C2 N=93						
7/2019						
Total SSI						2.72
4 question SSI					1.86	2.86
4. Ken 2017-C1 N=91						
7/2018, 12/2019						
Total SSI				2.23		2.64
4 ques. SSI			1.11	2.11	2.31	2.59
5. Ken 2017-C2 N=144						
12/2018						
Total SSI				2.46		
4 question SSI			1.59	2.50		
6. Ken 2018 N=240						
C1: 2/2018, 9/2019						
C2: 9/2018, 11/2019						
Total SSI		0.88		2.40		
4 question SSI	0.67	0.51	0.88	2.21		
7. Ken 2019-C1 N=221						
2/2019						
Total SSI		0.80				
4 question SSI	0.69	0.38				
8. Ken 2019-C2 N=122						
9/2019						
Total SSI		0.74				
4 question SSI	0.36	0.35				
Mean 4 question SSI	0.618	0.428	1.139	2.279	1.856	2.726
Number of Surveys	583	583	476	476	540	540

Section 3. Comparing Different Zoe Households (Cross-Sectional Analysis)

Cross-sectional analysis compares different cases, usually at one point in time. In this report this means that we compare different Zoe households. Usually we compare Incoming (zero months), Midpoint (eighteen months), or Graduate (thirty-six months) households, but we could also compare Zoe households by rural-urban residence, age of the household head, etc. The point is we are merely comparing different households. And, with cross-sectional analysis, we cannot know why they are different. We have no way to establish or even examine cause-and-effect relationships; that is, to identify the pure impact of the Zoe program. Cross-sectional comparisons do not measure *change* in anyone. The problem is there are always uncontrolled, alternative explanations. These we call "confounders."

On the other hand, cross-sectional comparisons certainly can be fascinating! They do *suggest* to us ideas about cause-and-effect. Additionally, they are often large and representative samples giving us excellent descriptions of large populations (without identifying causes). For example, please consider Table 3.

Table 3 provides some of the cross-sectional details in the Zoe survey results. For example, among the Incoming households, seventy-three percent said they beg for food, only sixteen percent agreed they were valuable members of their communities, and almost *none* agreed they eat at least two meals per day, eat enough to be satisfied, live in an adequate/safe house, or could provide necessities for their households.

In contrast, the responses from Midpoint and Graduate households were dramatically different from the Incoming households. For example, nearly 100 percent of Graduate household heads agreed that they were valuable members of their communities, that they eat at least two meals per day, eat enough to be satisfied, and could provide necessities for their households.

Table 4 summarizes our cross-sectional estimates of Zoe program impact. These numbers come from the bottom row of Table 2 and show the average 4qSSI for Incoming, Midpoint, and Graduate Zoe households in Kenya. They are presented here to summarize our first estimates of program impact into ***two numbers***. The estimate of program impact in the first eighteen months is ***1.85,*** the difference between Incoming and Midpoint households. The estimate of program impact in the last eighteen months is ***.45***, the difference between Midpoint and Graduate households.

Please look again at Table 1. Going up 1.85 from a beginning average .43 would move a child-led family from very vulnerable at .43 to self-sustaining (1.85 + .43 = 2.23) in eighteen months.

At this point however, it is important to note again that these cross-sectional data are merely suggestive. We are not really measuring change in anyone. Additionally, we cannot show proper time-order, that is, the cause has to happen before the result. Finally, with such cross-sectional data we cannot separate Zoe program impact from other confounding factors, known and unknown. For example, maybe Midpoint and Graduate groups were doing better than Incoming groups because the

household heads were older or more educated or more likely male or in a more prosperous village or smarter or had smaller households or lived closer to highways or enjoyed more rainfall or a thousand other potential "confounding variables."

Therefore, let us now turn to more rigorous assessments of pure Zoe program impact.

Table 3. Percent of Household Heads Agreeing with Selected Survey Items by ZOE Class: Kenya, Surveyed 2018 and 2019

	Percent Agreeing			Number
Survey Item	Incoming	Midpoint	Graduate	of Cases
I beg for food.	73	0	0	1599
I work for others and am paid with food.	82	0	2	1572
The number of meals I eat per day on average is 2 or more.	5	100	100	1599
I eat different types of food during the day.	7	93	100	1572
I eat enough each day that I am satisfied.	1	89	100	1599
I feel that I am a valuable member of the community.	16	98	96	1567
In the last year, I assisted poor/vulnerable people in my community (outside my ZOE group) without asking for payment.	11	82	92	1598
I have access to medical care.	3	95	97	1599
I know how and where to seek help if I experience abuse.	2	100	99	1599
I live in an adequate/safe house.	1	93	100	1599
I have had a problem in the last 12 months with my rights (land, belongings, or money taken; physical abuse).	64	26	9	1599
I can pay all the expenses (fees, uniforms, books) for all of the school-aged children in my household.	44	99	100	1443
I hire orphans/vulnerable people to help with my business/crops.	1	58	92	1599
Through my work, I can provide sufficient food, clothing, school expenses, and other necessities for my household.	0	96	100	1599
I feel free to worship as I want to in my group.	33	100	100	1599

Note: For this table each of these variables was recoded as binary "agree" or "not agree."

Table 4. Cross-Sectional Differences in Average Self-Sufficiency (4qSSI): Kenya, 2018 and 2019 Surveys

				Difference between	
	Incoming	Midpoint	Graduate	Incoming and Midpoint	Midpoint and Graduate
Mean 4qSSI	0.43	2.28	2.73	**1.85**	**0.45**
Number of Households	583	476	540		

Section 4. Comparing Zoe Households with Themselves (Panel Analysis)

Using panel analysis we can follow people through time and measure change in actual households. We are not comparing households with other households. We are comparing households *with themselves* at earlier and later times. In effect, the panel households serve as controls for themselves. That means we have filtered out all of the *known and unknown time-stable characteristics* of these households as explanations of SSI (Allison, page 1). For example, we have filtered out traits like intelligence, perseverance, extroversion, family background, village customs, etc. These examples are time-stable characteristics of the households. All such time-stable characteristics have been removed as potential explanations for the changes we see in 4qSSI. Panel analysis gives us that amount of power for understanding. Panel analysis gets us closer to identifying cause and effect.

However, there are two major weaknesses of panel designs. The first is the inability to control for all known and unknown *time-varying* household characteristics. Examples include maturing with age, the return of siblings, sickness, depression, family harmony, religious conversions, marriages, etc. The second weakness is the inability to control for all known and unknown factors *outside the household*. Examples here include locust plagues, cyclones, pandemic virus, end of a drought, gifts from relatives, national change elections, new paved roads, etc.

Clearly many factors beyond the Zoe program and household fixed characteristics can affect progress to self-sufficiency. We can explicitly control for some of these factors using multiple regression, if we can measure them. Still, with panel analysis we can never control for all possible variables that will compete with the Zoe program as explanations of change in self-sufficiency. In this way, panel analysis is much more powerful than cross-sectional analysis for detecting program impact (but much less powerful than DID quasi-experimental designs in Section 5).

We saw in Table 2 that we do have a panel for the second half of the three-year Zoe program. Cohort 4, the Kenyan class 2017-C1 answered the survey at the Midpoint of the program and again as they were Graduating. They are a panel and can really help us understand. These are real people we can follow through time.

Figure 3 introduces this second-half panel of ninety-one households. This figure is a scatterplot where Midpoint (eighteen-month) self-sufficiency flows left to right on the horizontal axis. The vertical axis is second-half (eighteen to thirty-six-month) *change* in self-sufficiency, flowing bottom-to-top on the vertical axis. Each dot represents one or more households. The number by each dot shows the number of households stacked up together in the same place, one on top of another.

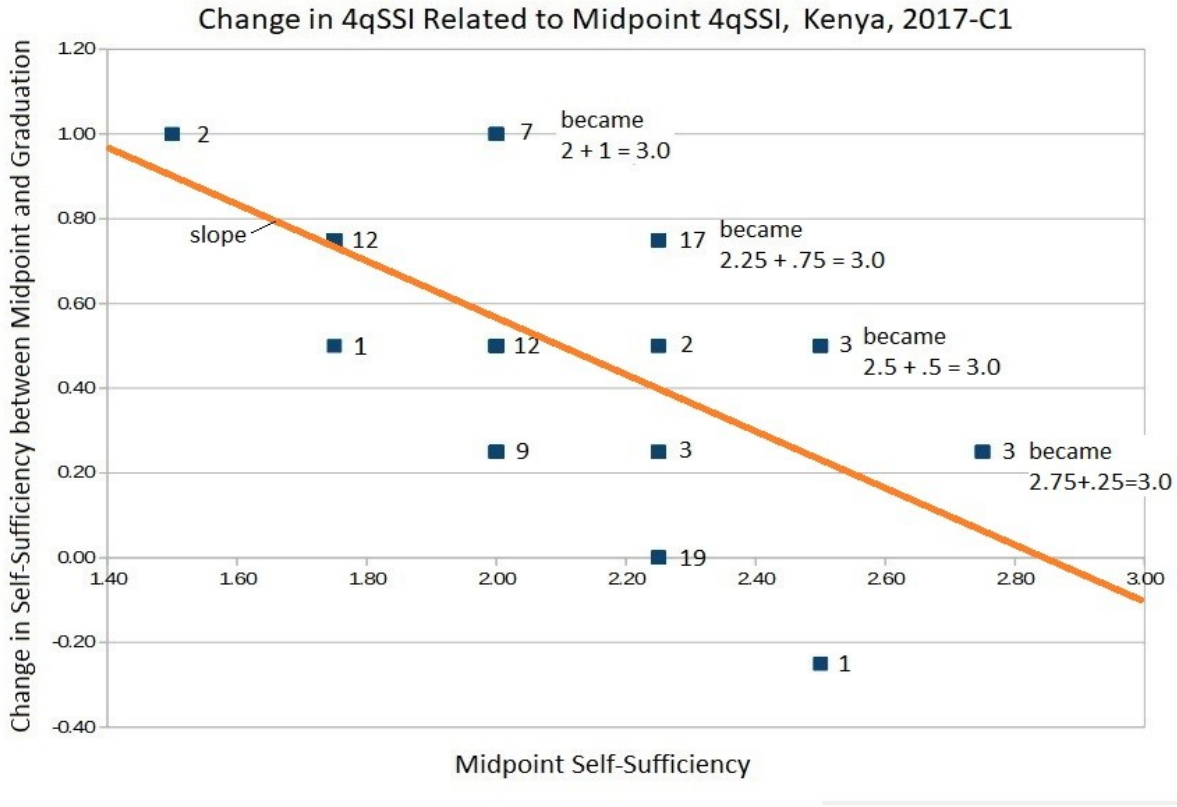

Figure 3: Change in 4qSSI Related to Midpoint 4qSSI

For example, on the far right are three households with a fantsastic eighteen month 4qSSI of 2.75. They were doing great at Midpoint! From 2.75 at Midpoint they increased the further .25 during the second half to achieve 3.00 by Graduation. During the second half of the Zoe program they increased from near (2.75) to full flourishing (3.00). Further to the left is a column of 41 households who were at 2.25 at Midpoint. At the top of the column are seventeen households who increased by .75 to 3.00, followed by two households who increased by .50 to 2.75 , three who increased by .25 to 2.50 , and ninteen households did not change from 2.25. One column to the left, seven households started at 2.00 (self-sustaining) and increased by 1.00 to 3.00 (flourishing).

Overall, the general pattern is described well by the straight line sloping down. We actually call this sloping line the “slope.” This “slope” says those households who started high went up less but still ended great. Those households who started lower went up more and also ended great. This general pattern should be very pleasing to us. The second half of the Zoe program seems to be about "catching up and consolidating," so many households eventually flourish!

Table 5. Panel Regressions to Explain 4qSSI of ZOE Households
In the Second Half of the Program: Kenya Cohort 2017-Class 1

Independent Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Intercept (18 months)	2.113	0.000	-	-	2.120	0.000
24 months	0.194	0.002	0.194	0.000	0.194	0.002
36 months	**0.475**	0.000	**0.475**	0.000	**0.475**	0.000
Household_1	-	-	2.027	0.000	-	-
Household_2	-	-	2.027	0.000	-	-
Household_3	-	-	1.944	0.000	-	-
Household_4	-	-	2.027	0.000	-	-
Household_5	-	-	2.027	0.000	-	-
Household_6	-	-	2.027	0.000	-	-
Household_7	-	-	1.944	0.000	-	-
Household_8	-	-	2.027	0.000	-	-
Household_9	-	-	1.944	0.000	-	-
Household_10	-	-	2.027	0.000	-	-
Household_11			1.944	0.000		
Household_12			1.944	0.000		
Household_13			2.027	0.000		
Household_14			2.027	0.000		
Household_15			2.027	0.000		
. . .						
Household_90	-	-	1.694	0.000	-	-
Household_91	-	-	1.944	0.000	-	-
Midpoint Age	-	-	-	-	0.037	0.022
Female Head	-	-	-	-	-0.055	0.290
Household Size	-	-	-	-	-0.046	0.013
2d Ed. Enrolled	-	-	-	-	0.078	0.158
N of Households	91		91		91	
N of Observations	3*91=273		3*91=273		3*91=273	
Adjusted R-squared	0.19		0.59		0.24	

Note 1: Robust standard errors are reported in Appendix Table 1.

Note 2: The independent variables 24 months, 36 months, and Female Head are dummy variables. Midpoint Age is age of the household head minus 15 (the actual minimum). Secondary Ed Enrolled is the highest formal education that anyone in the household has enrolled in, coded as 1=secondary or university and 0=none or primary.

Note 3: Regressing time-demeaned 4qSSI on the independent variables 24 months and 36 months did not change the estimated18-month program impact of .475.

Now, in Table 5, we introduce multiple regression of panel data as we continue to follow these same households through time. Using multiple regression analysis we want to draw from our panel all the information that we can. Table 5 shows a set of three multiple regression equations to explain 4qSSI in our second-half panel. The first equation is in the first two columns of numbers. This first equation tests the effect of time in the Zoe program (at eighteen months, twenty-four months, and thirty-six months) on self-sufficiency.

Let us step through the equation row by row. The first row holds the "intercept," the expected value of 4qSSI when time since Midpoint is zero. This 2.113 at Midpoint (eighteen months) is the same as the average 4qSSI at Midpoint for the Kenya 2017-C1 class. (See Table 2, Cohort 4). On average, these Zoe households were already self-sustaining (2.1) when the second half of the Zoe program *started.*

The other numbers in this column labeled "coefficient" are the slopes, also called partial regression coefficients. Please let us formally say how to interpret these numbers, and you will soon get the rhythm.

In general, we *interpret the slope (the regression coefficient) as the amount of change in the dependent variable (4qSSI) for a one unit change in that independent variable (time in the Zoe program)*, holding constant any other independent variables in the equation. For example, in this left-most equation, the third row holds the coefficient **.475**. This is our initial estimate of the "effect" of being in the Zoe program for thirty-six months rather than for eighteen months, that is, the second half impact of the Zoe program.

The column labeled "Prob." shows the probability that that coefficient is actually zero. This is its "statistical significance." In science, we usually require a probability of less than .05 (5 in 100 chance) before we accept an effect as real. We estimate the probability is .0000 that our second-half impact estimate .475 actually could be zero. This slope is highly statistically significant.

In human terms, this means that on average these households rose from self-sustaining at Midpoint (4qSSI = 2.113) to nearing flourishing at Graduation (4qSSI = 2.113 + .475 = 2.588). These are the averages shown in Table 2 for Cohort 4 (2017-C1). So, our best estimate so far of second-half Zoe program impact is .475.

The last piece of important information is on the bottom row of Table 5, the Adjusted R-Squared or "explained" variation. One aim of regression analysis is to ask and answer the question, "Why aren't all the households the same?" That is, why aren't all households right on the overall average? What we are trying to explain is this variation around the overall average (mean). R-Squared says how much of that variation is "explained by" (associated with) all the independent variables in that equation. Our R-Squared = .19 says that only 19 percent of this variation in 4qSSI is "explained by" or associated with time in the second half of the Zoe program. Second-half program time is not explaining much.

The second panel regression equation is in the middle two columns of numbers. Here we control specifically for *all known and unknown fixed characteristics* of each household. Here the coefficient column holds an intercept estimate for each individual household. (Technically, these are called "dummy variables.") For example, Households 1 and 2 each begin at 4qSSI = 2.027, Household_3 at 4qSSI = 1.944, etc. The effect of second-half time in Zoe remains unchanged at .475, still increasing 4qSSI just half a level toward flourishing. But now the R-Squared explained variation increases to 59

percent. This says there is much more difference *between* the households than there is change *within* each household connected with second-half Zoe time.

We can see this in Figure 4. On the left, each household starts at its own level at eighteen months and then increases only .475 to Graduation. Notice that the spread "between" households both on the left and the right is more pronounced than the change "within" each household over time.

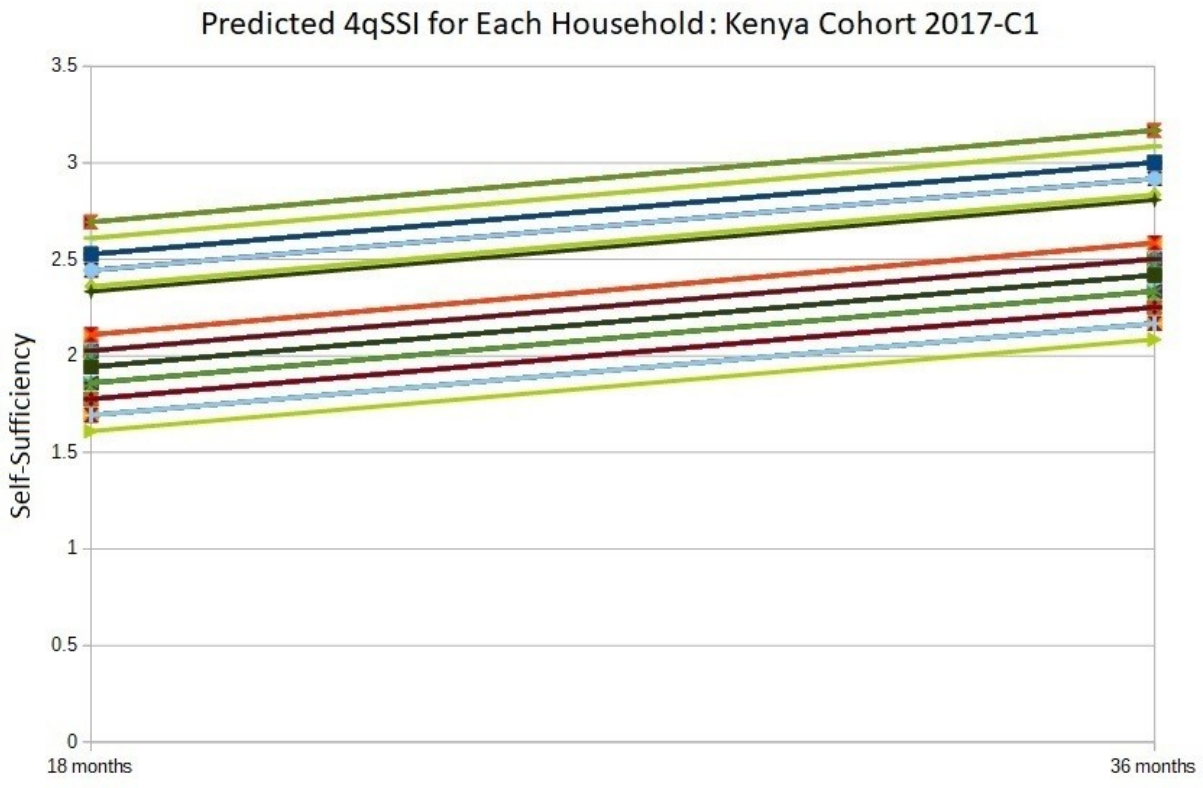

Figure 4: Predicted 4qSSI for Each Household

Technical Note: Another way to control for all fixed characteristics of each individual household is to "time-demean" the dependent variable 4qSSI. Then, each household is compared only to itself earlier and later. Time-demeaning the data in Table 5 left the panel estimate of Midpoint to Graduation Zoe program impact unchanged at .475, increasing 4qSSI half a level.

Finally, the last two columns of Table 5 try to identify the sources of these differences between households, using the few fixed household characteristics we have in the data set. These fixed characteristics are age and gender of the household head, household size, and the highest education level in which anyone in the household has enrolled. Only age and household size are statistically significant, but neither impact is very large.

Table 6 summarizes our efforts so far. For the first eighteen months of the three-year program, the estimated Zoe program impact on 4qSSI in Kenya is **1.85**, estimated from cross-sectional data. For the last eighteen months of the three-year program, the estimated Zoe program impact is **0.45** from cross-sectional data and **0.48** from panel analysis. It is reassuring that the two second-half estimates are so

close, even though program impact is modest. These estimates reinforce one another. Cross-sectional data has the advantage of a larger, more representative sample. Panel analysis has the advantage of tighter causal logic.

Still, we could wish for better evidence. Because there is no control group, we cannot know what would have happened to Zoe participants if their participation had ended after the first eighteen months. A control group is a critical part of rigorously assessing program impact. Fortunately, for the program's critical first eighteen months, we do have a usable comparison or "control" group, as shown in the next section.

Table 6. Estimated Change in Self-Sufficiency Connected with the ZOE Empowers Model: Kenya, 2018 and 2019 Surveys

Months 0-18 estimated from		Months 18-36 estimated from		Months 0-36 estimated from	
Cross-sectional Data	DID Analysis	Cross-sectional Data	Panel Analysis	Cross-sectional Data	DID and Panel Analysis
1.85		**0.45**	**0.48**	**2.30**	
1059 households		1016 households	91 households	1599 households	

Note: Self-Sufficiency is measured by the 4qSSI which ranges from 0.00 to 3.00, meaning 0.00=extremely vulnerable, 1.00=vulnerable, 2.00=self-sustaining, and 3.00=flourishing.

Section 5. Comparing Change in Zoe Households with Change in Non-Zoe Households (DID Quasi-Experiments)

Here we will set up a Difference-in-Differences (DID) quasi-experiment. The logic of DID is as follows. To begin, we carefully identify some Zoe participants as the treatment group, and we identify some nonparticipants as the comparison or "control" group. *If Zoe participants are exactly the same as nonparticipants in every way except Zoe program participation, then the differences in their later outcomes are due to program participation alone* (Lance, page 187). We then simply compare change in the participants with change in the nonparticipants. That is DID.

We saw in Table 2 that Cohort 6 (Kenya classes 2018-C1 and C2) can serve as a "treatment" group for a quasi-experiment. They answered the survey in 2018 at Incoming and again in late 2019 at Midpoint. Critically, we have an Incoming cohort (2019-C2 in Cohort 8) that also took their survey in late 2019. Because they answered 4qSSI questions for their year before entering Zoe (when they were non-participants), they may serve as a comparison group. This quasi-experiment should give us a good estimate of first half Zoe program impact. This sets up our DID quasi-experiment.

Though Zoe households were not randomly assigned to participant and nonparticipant categories, they were matched to some degree. Both were admitted to the program under the same criteria and from the same or similar communities. It is easy for us to believe we might accept the experience of the "matched" nonparticipants *as an estimate of what would have happened to the participants without the Zoe program*. This is called the parallel trend assumption. In any event, later we will check and adjust for treatment and comparison group mismatch using multiple regression.

What about time-stable, fixed characteristics of the households like intelligence? Both participants and nonparticipants are compared with themselves as our measure of change in the outcome. What about time-varying household characteristics? Both participants and nonparticipants would be subject to sickness, for example, as in any quasi-experiment. What about factors outside the household? Both participants and nonparticipants would be subject to cyclone damage, for example.

Conducting a simple *DID quasi-experiment* requires only four data points. For us, these are reported in Table 2. The rest you can do on the back of an envelope using a pencil.

Zoe Program Impact = (participant average Time 2 – participant average Time 1)
- (nonparticipant average Time 2 – nonparticipant average Time 1)

Figure 5 both calculates and illustrates our quasi-experiment. The average change for Zoe participants is 1.327 (= 2.212 - .885). This is the line going from .885 on the left to 2.212 on the right. The common time trend -.012 (= .348 - .360) is what did happen to Cohort 8 non-participants and what we think would have happened to participants but for Zoe. This is the line going from .360 on the left to .348 on the right. Using the parallel trend assumption, the common time trend also applies to the .885 on the left going to .873 on the right. Combined, the twelve-month program impact is 1.339.

Thus, from late 2018 to late 2019, the Zoe participants improved in 4qSSI an estimated average 1.339 *because of the Zoe program*. This means that in late 2019 the participants were at an average 4qSSI of 2.212 rather than .873 *because of the Zoe program in those twelve months.*

This is not a mere mathematics exercise. It really happened. Real people. For these young people that meant something profound. That meant moving up 1.4 levels of existence in only twelve months! Because of Zoe!

Tables 7 and 8 extend DID into more penetrating analysis. These tables put this same longitudinal data set into standard DID multiple regression models. Let's work our way through these tables.

In Table 7 the left pair of columns of numbers refer to the Zoe program during months six to eighteen. The right pair of columns refer to the Zoe program during months zero to eighteen.

Let's look first at the columns on the left for six to eighteen months. The intercept (.360) is the average 4qSSI for non-participants twelve months before they entered Zoe. At that time the Zoe participants already had been in the program for six months.

The coefficient for "Participant*18 months" (1.339, probability = .0000) is the "average program impact" between six months and eighteen months (if the parallel trend assumption is reasonable). S*o,*

this is the answer to the question, "How do we know if the program made a difference?" Just see how big is this coefficient and if it is statistically significant (prob. <.05).

The coefficient for "Participant" (.525) is "the fixed average difference between participants and nonparticipants" at the beginning. If this is significantly different from zero (prob. <.05), then the treatment and comparison groups were not well matched at the beginning. Here, we have a problem, because our groups were so different at six months of program time.

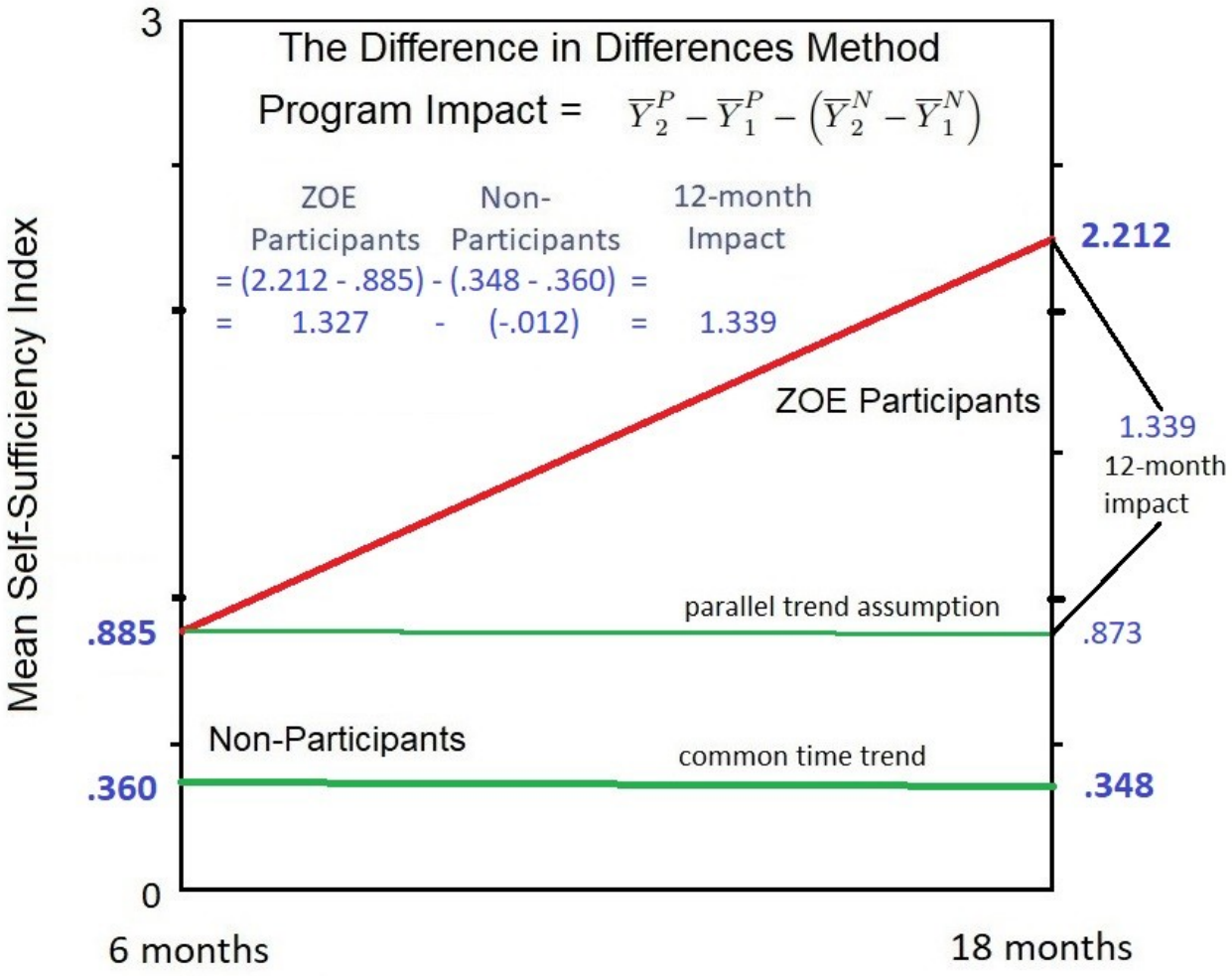

Figure 5: The Difference in Differences Method

The coefficient for "18 months" (-.012) is "the common time trend in the outcome between participants and nonparticipants," that is, the parallel trend assumption of what would have happened to the Zoe kids without their being in the Zoe program. Our twelve month common time trend is small and statistically insignificant (not meaningful).

Table 7. Standard DID Regressions to Explain 4qSSI of Households
In the First Half of the Program: Kenya Cohorts 2018 and 2019-C2

	Months 6 to 18		Months 0 to 18	
Independent Variable	Coefficient	Prob.	Coefficient	Prob.
Intercept	0.360	0.000	0.377	0.000
Participant*6months	-	-	0.392	0.000
Participant*18months	1.339	0.000	1.731	0.000
Participant	0.525	0.000	0.133	0.000
6months	-	-	-0.017	0.676
18months	-0.012	0.742	-0.029	0.462
N of Households	361		361	
N of Observations	2*361=722		3*361=1083	
Adjusted R-squared	0.85		0.84	

Robust standard errors are reported in Appendix Table 2.

Note for months 6 to 18: Regressing time-demeaned 4qSSI on these independent variables did not change the estimate of 12-month program impact 1.339.

Note for months 0 to 18: Regressing time-demeaned 4qSSI on these independent variables did not change the estimate of 18-month program impact 1.731.

We can see these quantities in Figure 5, shown above.

– The intercept (.360) is the average (mean) SSI for non-participants at twelve months before Zoe (when participants were six months into the program).

– The participant effect is enormous at .525, the initial "Zoe – NotZoe" difference at six months of program time. Just start at .360, add the .525 participant advantage, and you arrive at .885 where the participants began.

– The common time trend is -.012, small and statistically insignificant. Use the parallel trend assumption to move participants along the common time trend (-.012), and you arrive at .873.

– The Zoe program impact in that twelve months is large (1.339). Add program impact to where participants would be without Zoe (.873), and you arrive at 2.212, the actual participant Midpoint 4qSSI.

Lastly, we see in Table 7 that this prediction equation is amazingly accurate. That is, eighty-four percent of the variation around the overall mean is accounted for by only two factors, being a participant and having more time in the Zoe program (and their interaction).

There you have it! Now we accurately can say there was an average 4qSSI increase of 1.339 for these Zoe participants in that twelve month period because of participation in the Zoe program.

But there is a problem, the large participant effect of .525. We can see no other reason that the Zoe participant advantage should be so large - except that the Zoe households had six months more time in the Zoe program in those critical first six months. Participants and non-participants should have been similar when this experiment started. The Incoming children were recruited under the same guidelines using the same procedures as the Midpoint children (recruited eighteen months earlier).

Therefore, we propose that the search for truth is best served by linearly extrapolating backwards the 4qSSI for each comparison group household, back to eighteen months before Zoe. This backwards adjustment will be small because the twelve-month change for the comparison group was very small and statistically insignificant. Additionally, we do have good measurement at zero months for the treatment group from their Incoming Surveys. This procedure provided the data points for the right two columns of Table 7, which we now interpret.

- The intercept at .377 is the assumed mean for non-participants at eighteen months before Zoe.

- The Zoe program impact for the first eighteen-month is an amazing **1.731**.

- The participant effect is now much smaller at .133.

- The common time trend is -.029 (not significantly different from zero).

The procedure worked. Participant effect and common time trend are now much smaller. And most importantly, the substantive results are truly impressive. *In eighteen months the Zoe program itself raised these young households 1.731, from very vulnerable to self-sustaining.*

Figure 6 shows the full regression equation and also illustrates these relationships shown in Table 7. We begin on the bottom left of the chart at the nonparticipants' average .377 4qSSI (partly based on backward extrapolation). Next, we move to the right side along the common time trend -.029, using the assumption that what did happen to nonparticipants would have happened to participants but for Zoe. Next, we add the .133 initial participant difference from the nonparticipants. Finally, we add the very large Zoe program impact 1.731. All of this leads to the Zoe participants' actual average 4qSSI of 2.212 at program Midpoint. This not make-believe. This actually happened!

Technical note: As noted at the foot of Table 7, regressing time-demeaned 4qSSI on these independent variables did not change the program impact estimates. Now, we can use the limited "between" household variation that exists to test some fixed characteristics in the data set, as shown in Table 8.

Table 8 provides final tests of these impact estimates. The left two columns report coefficients for program months zero to eighteen. Here also we add four characteristics of each household to see if they independently explain part of the change in self-sufficiency, apart from program participation. The new competing explanations (independent variables) are age and gender of the household head, household size, and highest formal educational enrollment level.

Eighteen-month Zoe program impact remains essentially unchanged at 1.730 despite adding competing explanations into the equation. Participant fixed effect is still modest (.148), and the common time trend -.029 is not significantly different from zero. Of the new competing explanations, only having a

female head of household (.098) is significant (probability less than .05) and the independent effect is small.

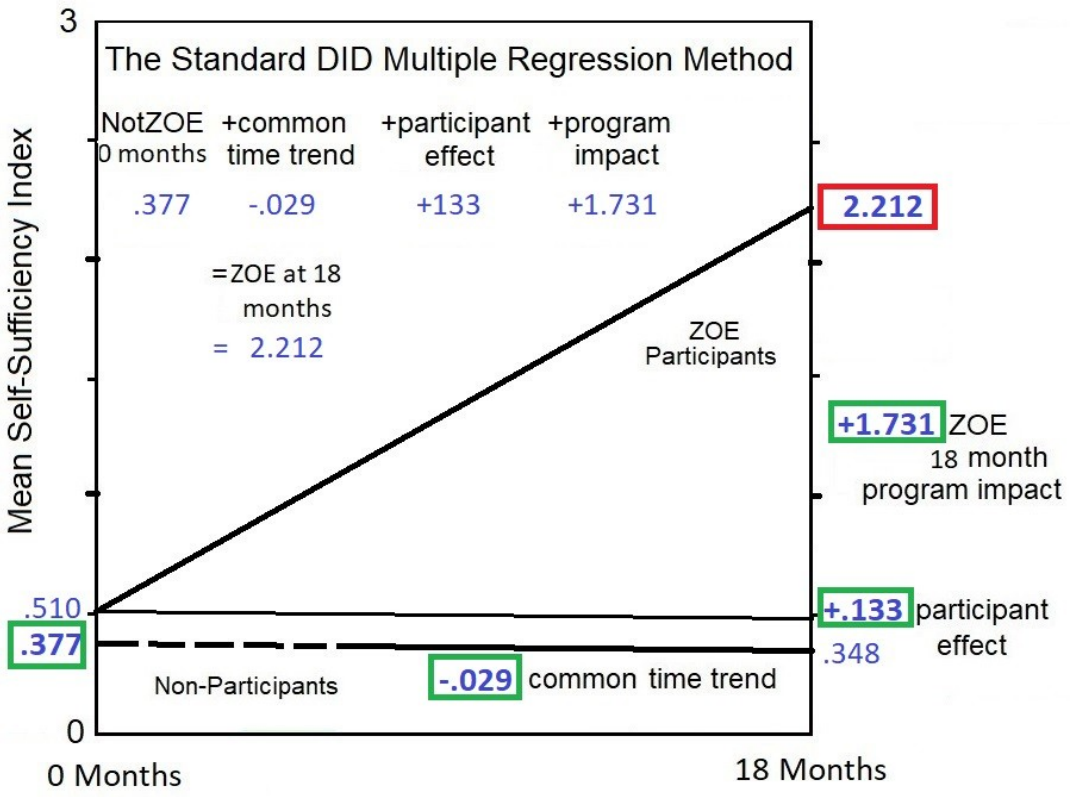

Figure 6: The DID Multiple Regression Method

The remaining columns in Table 8 provide better controlled tests by comparing only the households who lived in the same sub-county districts within Meru County, Kenya. Comparing these households alone should give a better estimate of program impact because treatment and comparison groups would be better matched. The Igembe North sub-county (2019 population 169,000) included 59 of our non-participant households to match with 30 Zoe participant households. Their DID estimate of first-half program impact is 1.669. This further supports our preferred estimate of 1.73. The Tigania East sub-county (2019 population 73,000) included 32 comparison group households and 59 participant households. Their DID estimate of Zoe first-half program impact is 1.994, higher than our 1.73. All these tests affirm the average participant family rose from *very vulnerable to beyond self-sustaining* in eighteen months because of Zoe alone. Amazing!

Finally, there is one additional quasi-experimental comparison available from Table 2. That is comparing Cohort 5 with Cohort 7. Only the twelve-month program estimate is available, and that estimate is 1.22, fully in line with our other estimates of first-half program impact.

Table 8. Difference-in-Differences Regressions to Explain 4qSSI of Households In the First Half of the Program: Kenya Cohorts 2018 and 2019-C2

	Months 0 to 18		Igembe North Only		Tigania East Only	
Independent Variable	Coefficient	Prob.	Coefficient	Prob.	Coefficient	Prob.
Intercept	0.361	0.000	0.417	0.000	0.023	0.683
Participant*6months	0.391	0.000	0.531	0.000	0.348	0.000
Participant*18months	1.730	0.000	1.669	0.000	1.994	0.000
Participant	0.148	0.000	0.114	0.052	0.404	0.000
6months	-0.017	0.673	0.002	0.961	-0.004	0.852
18months	-0.029	0.457	0.006	0.890	0.066	0.028
Midpoint Age	-0.004	0.607	0.011	0.363	-0.017	0.159
Female Head	0.098	0.000	0.009	0.802	0.071	0.051
Household Size	-0.012	0.186	0.003	0.824	0.005	0.740
2d Ed. Enrolled	-0.002	0.926	-0.006	0.900	-0.125	0.014
N of Households	361		89		91	
N of Observations	3*361=1083		3*89=267		3*91=273	
Adjusted R-squared	0.84		0.86		0.93	

Note 1: Robust standard errors are reported in Appendix Table 3.

Note 2: The independent variables Participant, 6 months, 18 months, and Female Head are dummy variables. Midpoint Age is age of the household head minus 14 (the actual minimum). Secondary Ed Enrolled is the highest formal education that anyone in the household has enrolled in, coded as 1=secondary or university and 0=none or primary.

****

In conclusion, we present our final assessment of Zoe program impact in Table 9.

In this table, for the first eighteen months of the three-year program, the estimated Zoe program impact on 4qSSI in Kenya is **1.85** from cross-sectional data and **1.73** from DID analysis. Cross-sectional data have the advantage of a larger and more representative sample, while DID has the advantage of excellent causal logic.

For the last eighteen months of the three-year program, the estimated Zoe program impact is **0.45** from cross-sectional data and **0.48** from panel analysis. Again, cross-sectional data have the advantage of a larger, more representative sample, and panel analysis has the advantage of tighter causal logic. (However, with no control group, we cannot estimate what would have happened to Zoe participants if their participation had ended at eighteen months.)

Table 9. Estimated Change in Self-Sufficiency Connected with the ZOE Empowers Model: Kenya, 2018 and 2019 Surveys

Months 0-18 estimated from		Months 18-36 estimated from		Months 0-36 estimated from	
Cross-sectional Data	DID Analysis	Cross-sectional Data	Panel Analysis	Cross-sectional Data	DID and Panel Analysis
1.85	**1.73**	**0.45**	**0.48**	**2.30**	**2.21**
1059 households	361 households	1016 households	91 households	1599 households	452 households

Note: Self-Sufficiency is measured by the 4qSSI which ranges from 0.00 to 3.00, meaning 0.00=extremely vulnerable, 1.00=vulnerable, 2.00=self-sustaining, and 3.00=flourishing.

Which estimates can we accept as true? What's to worry? They all point to the same conclusion, *a three-year Zoe program impact of 2.3.* Add together the cross-sectional estimates, and we have **2.30** impact in the three-year program. Then, add together the DID and panel estimates, and we get **2.21** impact in the three-year program. Then add either estimate to the average Incoming 4qSSI (0.43), and it becomes about 2.7, the actual average for Graduating Kenyan Zoe participants. *That means rising from very vulnerable to near holistic flourishing in thirty-six months however we assess!*

By any reckoning, that is an amazing transformation. Of course, the "Zoe program" is not a thing. It literally means the Zoe Empowers Model as lived out through the cooperation, intelligence, and effort of Zoe staff, donors, and many brilliant and energetic young entrepreneurs. "Congratulations" especially go to Reegan Kaberia, Chief Program Officer and Kenya Country Manager, and Epiphanie Mujawimana, Rwanda Country Manager and Primary Inventor of the Zoe Empowers Model.

Section 6. The Heart of the Zoe Empowers Model (Path Analysis)

So, how does the Zoe Empowers Model achieve these results? The approach we would like to take comes from sociological theory, specifically functionalist thinking about expressive and instrumental needs.

According to theory, expressive needs focus on our deep desires for social connections, emotional support, understanding, and social cohesion. We think of these as basic, foundational requirements for humans to exist - requirements of the "soft" variety.

In a different way, according to this theory, instrumental needs focus on getting things done, achieving concrete goals, maintaining productivity, and accomplishing specific tasks like earning money. We

think of these also as basic, foundational requirements for humans to exist – requirements of the "hard" variety.

Evidence from the World Happiness Report 2020 indicates these ideas are true. The report summarizes more than two million surveys (Gallop World Poll) from 156 nations over fifteen years - into one regression equation (Helliwell, Table 2.1, page 16). Amazing! The dependent variable is self-reported life satisfaction (a Cantril Ladder 0 to 10 scale). There are six explanatory variables, each well-established in the scientific literature on happiness. These are (1) social support, (2) income, (3) healthy life expectancy, (4) freedom, (5) generosity, and (6) absence of corruption.

The results are that social support and income are the best predictors of life satisfaction (page 18). Social support explains 33% of the variation in average life satisfaction for the nations of the world, and income explains 25%. What more can we ask of science?

So, our expectation here is that the Zoe model is successful because it simultaneously, intentionally, and equally addresses foundational needs of both the "soft" and "hard" varieties.

To examine this, we tried to capture these ideas using forty items in the Zoe survey. Factor analysis and item reliability analysis reduced these forty to thirty-two items, sixteen in an expressive index and sixteen in an instrumental index. Table 10 shows the results.

Each of the thirty-two items was recoded into binary categories (no = 0, yes = 1). For example, the responses to "I feel God loves me" were recoded from four categories (strongly disagree, disagree, agree, strongly agree) into two categories (no or yes). Likewise, the responses to "I use clean or boiled water" were recoded from four (never, seldom, usually, always) into two (no or yes). Then, each index simply became the sum of the its sixteen items. Therefore, on each survey each household could have scored from zero to sixteen on each index. (The panel households each took the survey twice.)

From Table 10 you can see that the items in the expressive index focus on social connections, the "soft" side of basic human needs. Most of these items refer to "my Zoe group" or to "worship." Additionally, most of the individual items as well as the overall index are highly correlated with months in the Zoe program. That is, more time in Zoe means more "no's" become "yes's" regarding basic human needs for social and spiritual connection.

Similarly, the instrumental items concentrate on basic, business-like income concerns, the "hard" side of basic human needs. These items deal with income and business development as absolutely fundamental to decent living. Again most individual items as well as the overall index correlate highly with time in the Zoe program.

Figure 7 shows the relationships among meeting expressive needs, meeting instrumental needs, and the achieved levels of self-sufficiency for these sampled Kenyan households. (This plot shows a random sample of 300 of the 1,599 surveys.) "Meeting Expressive Needs" varied from zero on the bottom (yes, there were households at zero) to sixteen on the top. "Meeting Instrumental Needs" varied from zero on the left to sixteen on the right. Clearly, when one index was low, the other index was low. And when one index was high, the other was high. There really were no exceptions, no outliers.

Table 10. Items in the Expressive and Instrumental Indexes:
Kenya, 2018 and 2019 Surveys (N=1599 Households)

Index and Items	Correlation with months in ZOE
Meeting Expressive Needs Index	0.829
I did table banking in my ZOE group last year.	0.844
I know and enforce my rights.	0.834
I got social support from my ZOE group last year.	0.821
I felt safe/secure in my ZOE group last year.	0.802
I attend community events.	0.792
I got group project income in my ZOE group last year.	0.776
I got a business grant from my ZOE group last year.	0.750
Visitors come to my home.	0.730
I did mutual help in my ZOE group last year.	0.691
I hold leadership in my place of worship.	0.511
I attend worship services.	0.507
I got an emergency loan from my ZOE group last year.	0.444
My ZOE group helped when I was sick last year.	0.436
I got a house loan from my ZOE group last year.	0.429
I bought at wholesale prices in my ZOE group last year.	0.331
I feel God loves me.	0.324
Meeting Instrumental Needs Index	0.870
I did home improving in the past 3 years.	0.824
I have businesses with income.	0.823
I am able to buy and/or grow my own food.	0.816
I use clean or boiled water.	0.804
My business had profits this past year.	0.803
I have crops and/or livestock to sell.	0.790
I have an adequate toilet.	0.788
Our household has savings.	0.775
I invested in my business this past year.	0.758
I invested in farming this past year.	0.656
Our household owns livestock.	0.649
I built a latrine in the past 3 years.	0.630
I own a home or rent housing by paying money.	0.582
I expanded my house in the past 3 years.	0.555
I repaired my house in the past 3 years.	0.476
I bought productive assets this past year	0.417

Note: Cronbach's alpha =.953 for Expressive and =.964 for Instrumental Indexes.

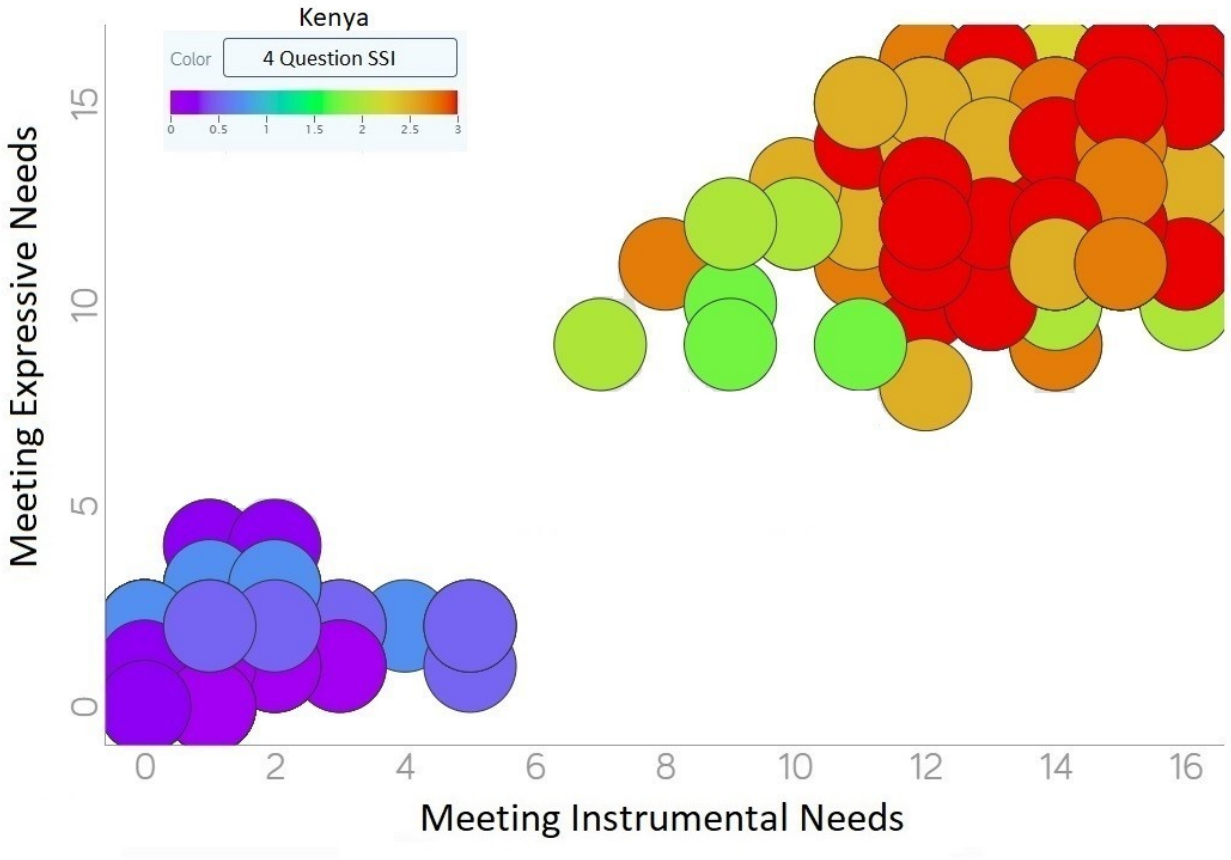

Figure 7: Correlations Among 4qSSI, Expressive, and Instrumental Indexes

The color in each circle shows the achieved level of self-sufficiency (the 4qSSI). The purples are in the lower left corner, lowest simultaneously on instrumental, expressive, and 4qSSI. The greens are simultaneously quite high on instrumental, expressive, and 4qSSI. And the reds are simultaneously high on all three variables.

Path analysis is an old technique but still helpful for connecting concepts with evidence. The job of path analysis is to measure the sizes of causal links and then summarize the direct, indirect, and total effects of each causal variable. Path analysis is based on path diagrams. Figures 8 and 9 are path diagrams for our concerns. Figure 8 summarizes data for the first half of the Zoe program, and Figure 9 summarizes data for the second half of the Zoe program.

Please refer to Figure 8. Our expectations for this causal system are as follows. Because of the Zoe model, more months in the program should lead directly to meeting instrumental needs and to meeting expressive needs and through them to greater self-sufficiency (4qSSI). These links are shown as thick arrows left-to-right.

Zoe months may also affect 4qSSI directly (in other unspecified ways). This is the thin arrow directly from months to self-sufficiency. (Plus, months can change instrumental needs which change expressive needs which change 4qSSI. Also, months can change expressive needs which change instrumental

needs which change 4qSSI). Instrumental can have its own independent effect on 4qSSI, both directly and through expressive. And expressive can have its own independent effect on 4qSSI, both directly and through meeting instrumental needs. These are the various paths through this diagram of causal pathways.

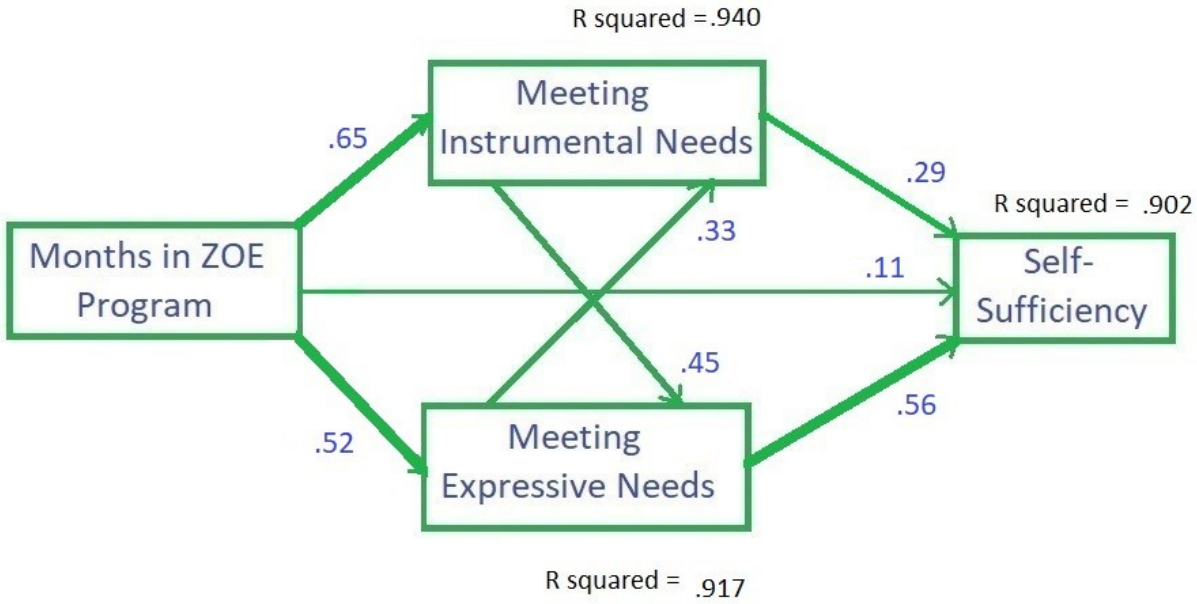

Figure 8: Path Diagram for the First Half of the Zoe Program

The data for Figure 8 come from the cross-sectional surveys of 1,059 Incoming and Midpoint households. (Separate analysis of our first-half panel of 240 households yielded very similar results.) The numbers on the causal arrows in Figure 8 are the standardized partial regression coefficients (the beta weights from OLS multiple regression). All we are concerned about now is the relative sizes of these causal links.

In Figure 8 we can see that Zoe months had a big influence on meeting expressive needs (.52) and that meeting expressive needs itself increased self-sufficiency a lot (.56). The pattern of causal influence was similar through instrumental needs. Zoe months very strongly influenced the meeting of instrumental needs (.65) and that increased 4qSSI (.29). The direct influence of months in Zoe on self-sufficiency in the first half of the program was small (.11). R-squared = .902, so, the equation is a nearly complete explanation of levels of self-sufficiency in the first half of the Zoe program.

In the first half of the program, the Zoe Empowers method is remarkably effective because it simultaneously, intentionally, and equally addresses foundational human needs – both of the "soft" and the "hard" varieties. This is what we see as the meaning of this path diagram and as the heart of the Zoe Empowers Model.

Of course, the Zoe Empowers Model is not a thing. It literally means a way of organizing the intelligence and effort of Zoe staff (including mentors), donors, and many enterprising and energetic young entrepreneurs.

Figure 9 organizes a similar path analysis of the second half of the Zoe program in Kenya. Again the data for this analysis is cross-sectional (1,016 surveys). And again a separate analysis of our second-half panel (ninety-one households) showed similar results.

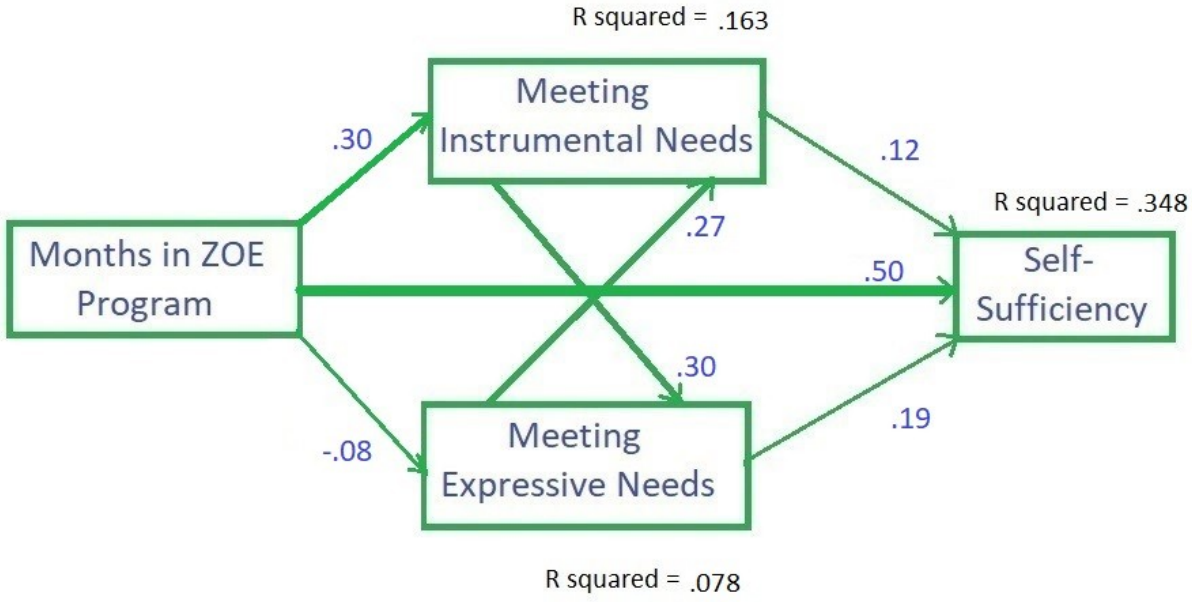

Figure 9: Path Diagram for the Second Half of the Zoe Program

Here we see that months in the Zoe program in the second half (months eighteen through thirty-six) still had a positive impact on achieving self-sufficiency. But here that impact was direct (.50) and moderate (R-squared = .348). There are no other strong arrows going into the 4qSSI dependent variable. The impact of months in Zoe did not go through meeting basic instrumental nor expressive needs. Something else (unspecified) was happening.

Indeed, meeting basic, foundational needs of both kinds was achieved by the Midpoint. Those achievements in the first half of the program seem to be the heart of the Zoe Empowers Model.

For the Midpoint households, the average instrumental index was already high at 13 and the average expressive index was also 13. Graduates had almost the same average scores as the Midpoint households, 14 for instrumental and 13 for expressive. (Please remember the highest these indexes can go is 16.) But for Incoming households the comparable numbers were very low, 1 on instrumental and 2 on expressive.

Therefore, in the second half from Midpoint to Graduation something else was going on. We describe it as "catching up and consolidating" but really do not know what caused the second-half rise in self-sufficiency. But whatever it is, it is moderately connected with time in the Zoe program. Probably, Zoe staff will know what it is. They DO it every day.

The last table, Table 11, summarizes this path analysis exercise. From Incoming to Midpoint (zero to eighteen months) the impact of months in Zoe is very large (.80) and mostly indirect (.69), through addressing foundational expressive and instrumental needs – the heart of the Zoe Model. Both cross-sectional and panel data sets give surprisingly similar assessments.

From Midpoint to Graduation (eighteen to thirty-six months) the impact of months in Zoe is still large (.54) but now direct (.50), affecting self-sufficiency in unspecified ways.

In summary, the Zoe Empowers method is remarkably effective because it simultaneously, intentionally, and equally addresses foundational human needs – both of the "soft" and the "hard" varieties. We call this the heart of the Zoe Empowers Model.

Table 11. Direct, Indirect, and Total Effects on Self-Sustainability: Kenya, 2018 and 2019 Surveys

	From Cross-Sectional Data			From Panel Analysis
Variable	Direct	Indirect	Total	Total
Incoming to Midpoint				
Months in ZOE	0.11	0.69	0.80	0.76
Instrumental	0.29	0.25	0.54	0.69
Expressive	0.56	0.10	0.66	0.59
Number of households			1,059	240
Midpoint to Graduate				
Months in ZOE	0.50	0.04	0.54	0.66
Instrumental	0.12	0.06	0.18	0.27
Expressive	0.19	0.03	0.22	-0.34
Number of households			1,016	91

Section 7. Conclusions

1. All our estimates point to the same conclusion. In Kenya there was an average three-year Zoe program impact of 2.3. This means these young households rose in thirty-six months from *grave vulnerability* (average Incoming 4qSSI of 0.43) to *holistic near flourishing* (average Graduate 4qSSI of 2.73). 100 percent of Zoe Graduating households had become self-sustaining. No one was left behind! This assessment is based on cross-sectional analysis of 1,599 cluster-sampled households, panel analysis of 91 households in the second half, and difference-in-differences quasi-experiments of 361 households in the first half of the Zoe program.

2. In addition, path analysis says the Zoe Empowers Model is remarkably effective because it simultaneously, intentionally, and equally addresses foundational human needs – both the "social support" and the "income" varieties of basic human needs.

3. By any reckoning, this is an amazing transformation. Of course, the "Zoe program" is not a thing. It literally means the Zoe Empowers Model as lived out through the cooperation, intelligence, and effort of Zoe staff, donors, and the many enterprising and energetic young entrepreneurs. "Congratulations" especially go to Reegan Kaberia, Chief Program Officer and Kenya Country Manager, and Epiphanie Mujawimana, Rwanda Country Manager and Primary Inventor of the Zoe Empowers Model.

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Most of the data analysis was generated using MicrOsiris software, Version 24, Copyright 2014 from www.microsiris.com. MicrOsiris is an excellent, powerful, no-cost, graphics-interfaced statistics software package developed at the University of Michigan. It was maintained for years by the United Nations under the name IDAMS for use by international development programs. Regression analysis used the excellent, no-cost Excel Add-in (www.real-statistics.com) by Charles Zaiontz.

Who is the author? I am a sociologist-demographer (PhD. University of Chicago, 1976) who retired in 2001 as a research-active Professor at LSU in Shreveport. My wife, Carrie, and I have been familiar with Zoe since 2008 and have partnered with 13 Empowerment Groups (1,135 children and youth). We have traveled to Kenya, India, Rwanda, and Liberia to meet many of these young people and visit their businesses and homes.

Appendix Table 1. Panel Regressions to Explain 4qSSI of ZOE Households In the Second Half of the Program: Kenya Cohort 2017-Class 1

				Dependent Variable Time-Demeaned					
Independent Variable	4qSSI Coeff.	Std. Error	Prob.	4qSSI Coeff.	Std. Error	Prob.	4qSSI Coeff.	Std. Error	Prob.
Intercept (18 months)	2.113	0.026	0.000	-0.223	0.024	0.000	2.120	0.080	0.000
24 months	0.194	0.063	0.002	0.194	0.036	0.000	0.194	0.061	0.002
36 months	0.475	0.042	0.000	0.475	0.032	0.000	0.475	0.041	0.000
Midpoint Age	-	-	-	-	-	-	0.037	0.016	0.022
Female Head	-	-	-	-	-	-	-0.055	0.052	0.290
Household Size	-	-	-	-	-	-	-0.046	0.018	0.013
2d Ed. Enrolled	-	-	-	-	-	-	0.078	0.055	0.158
N of Households	91			91			91		
N of Observations	273			273			273		
Adjusted R-squared	0.19			0.42			0.24		

Note: The independent variables 24 months, 36 months, and Female Head are dummy variables. Midpoint Age is age of the household head minus 15 (the actual minimum). Secondary Ed Enrolled is the highest formal education that anyone in the household has enrolled in, coded as 1=secondary or university and 0=none or primary.

Appendix Table 2. Standard DID Regressions to Explain 4qSSI of Households In the First Half of the Program: Kenya Cohorts 2018 and 2019-C2

	Months 6 to 18			Months 0 to 18		
Independent Variable	Coeff.	Std.Error	Prob.	Coeff.	Std.Error	Prob.
Intercept	0.360	0.026	0.000	0.377	0.031	0.000
Participant*6months	-	-	-	0.392	0.051	0.000
Participant*18months	1.339	0.048	0.000	1.731	0.048	0.000
Participant	0.525	0.036	0.000	0.133	0.036	0.000
6months	-	-	-	-0.017	0.041	0.676
18months	-0.012	0.035	0.742	-0.029	0.039	0.462
N of Households	361			361		
N of Observations	722			1083		
Adjusted R-squared	0.85			0.84		

Note for months 6 to 18: Regressing time-demeaned 4qSSI on these independent variables did not change the estimate of 12-month program impact 1.339.

Note for months 0 to 18: Regressing time-demeaned 4qSSI on these independent variables did not change the estimate of 18-month program impact 1.731.

Appendix Table 3. Difference-in-Differences Regressions to Explain 4qSSI of Households In the First Half of the Program: Kenya Cohorts 2018 and 2019-C2

Independent	Months 0 to 18			Igembe North Only			Tigania East Only		
Variable	Coeff.	Std.Err.	Prob.	Coeff.	Std.Err.	Prob.	Coeff.	Std.Err.	Prob.
Intercept	0.361	0.047	0.000	0.417	0.067	0.000	0.023	0.057	0.683
Participant*6months	0.391	0.050	0.000	0.531	0.080	0.000	0.348	0.044	0.000
Participant*18months	1.730	0.047	0.000	1.669	0.072	0.000	1.994	0.069	0.000
Participant	0.148	0.039	0.000	0.114	0.058	0.052	0.404	0.040	0.000
6months	-0.017	0.040	0.673	0.002	0.044	0.961	-0.004	0.021	0.852
18months	-0.029	0.039	0.457	0.006	0.046	0.890	0.066	0.030	0.028
Midpoint Age	-0.004	0.007	0.607	0.011	0.012	0.363	-0.017	0.012	0.159
Female Head	0.098	0.022	0.000	0.009	0.034	0.802	0.071	0.036	0.051
Household Size	-0.012	0.009	0.186	0.003	0.014	0.824	0.005	0.015	0.740
2d Ed. Enrolled	-0.002	0.025	0.926	-0.006	0.046	0.900	-0.125	0.050	0.014
N of Households	361			89			91		
N of Observations	1083			267			273		
Adjusted R-squared	0.84			0.86			0.93		

Note: The independent variables 24 months, 36 months, and Female Head are dummy variables. Midpoint Age is age of the household head minus 14 (the actual minimum). Secondary Ed Enrolled is the highest formal education that anyone in the household has enrolled in, coded as 1=secondary or university and 0=none or primary.