THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF ECONOMICS

TO TRANSFER OR STAY: A LOOK AT FUTURE EARNINGS OF PENN STATE STUDENTS AFTER TRANSFERS WITH A FOCUS ON LOW-INCOME AND FIRST-GENERATION STUDENTS

JACOB FOOSE
SPRING 2018

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree
in Economics
with honors in Economics

Reviewed and approved* by the following:

Russell Cooper
Distinguished Professor of Economics
Thesis Supervisor

Russell Chuderewicz
Teaching Professor of Economics
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

The field of educational economics has focused on many topics related to a student's attainment and acceptance into college. On the other hand, much less focus has been given to the idea of transferring from one university to another. Utilizing Penn State's ecosystem as a microcosm of college in general, conclusions about college transfers as a whole can be inferred. Also, the impact of a student being low-income or first-generation can be quantified utilizing the simulation that is used to model Penn State's ecosystem. In the end, ideas such as cultural mismatch do not explain the dropout and transfer rates at Penn State. The effect of different backgrounds however, is quantified.

TABLE OF CONTENTS

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to thank my family, my friends, and anyone who has put up with me while I have been along the wild ride that is Penn State. I could not have done any of this without you all. I would like to thank the Schreyer Honors College for their support over the last four years, as well as the opportunities they have given me that I could never have gotten anywhere else.

I would like to thank my thesis advisor, Russell Cooper, for helping me with so much over the past year with this project. I would also like to thank Russell Chuderewicz for being my thesis supervisor as well as giving me the advice in my first week of school that put me along the path to study economics.

Finally, a shoutout to YouTube user ChilledCow whose lofi hip radio station was the soundtrack to all of these pages.

Chapter 1

Introduction

There is a plethora of research that looks at college and its effects on students. There is good reason for this. College is a major investment for many students. At the same time, college also tends to lead to higher income later on in a student's life. Research focuses on many topics, such as how students decide which university to attend, what different facts about their backgrounds can lead to, and more. One of the glaring holes in this area of research is the likelihood of college transfers and their effect on long-term economic gains. Furthermore, the likelihood of college transfers is something that has not been looked at in terms of how it affects low-income or first-generation students.

Why is a student's history of transfer important? It has to do with what one considers going to college. If transfers are not important to lifetime earnings of a student, then one would only see students transfer for personal reasons. These reasons would include being closer to home, tuition differences, or person attachment to a certain school. This is opposed to academic and financial reasons, such as a better program in one's field of study or the likelihood of a higher paying job. Because students transfer for these reasons, just attending college alone is not the most important part of an academic career. It could come down to graduation, but then that would incentivize students to stay at a cheaper or less rigorous university and then transfer to a more prestigious one as close to graduation as they could. Again, this is not what appears to happen in real life. There must be a reason some students transfer from one university to the next, and this paper aims to find out why. An explanation commonly given for the decisions

someone makes when attending college is mismatch. This paper will look further into the idea of cultural mismatch and how it affects students, as opposed to the idea of educational mismatch, which is what is commonly used as an explanation.

In order to do so, this paper examines information found in Penn State's 2008 Cohort Generation and Income Status Report. This looks at various factors of the Penn State's 2008 Cohort Generation, which is students who began attending the university in the Summer or Fall semesters of 2008. Various information is contained in this report, such as average amount of semesters needed for a student to graduate, mean SAT score, and graduation rate. These are broken down by which Penn State campus a student is attending and whether or not they transferred to another Penn State campus.

This paper will make its conclusions by developing a theoretical three-period model of college education. This model will encompass a student's initial decision of attending school or going right to work, their decision to stay where they are, to transfer, or to drop out, and then their finial lifetime earnings as a result of their choices in the first two periods. An in-depth explanation of this model and how it was formed will precede the results. Using the results, the concrete impact of a student being from a low-income background or being a first-generation student can be discovered. A discussion of the results will follow.

Chapter 2

Why Study Penn State?

There are many reasons to use Penn State as the vehicle for this analysis, besides obvious bias in favor of it. A major reason for doing so is that all information is shared between campuses. In other cases, the academic history of someone who transferred from one university to another may be lost or difficult to obtain. Doing that for a university's entire cohort class could prove to be a massive undertaking. With Penn State, the students staying within the ecosystem are extremely easy to track, as they continue to use the same university resources.

The close relationship of each of the Penn State campuses also allows for ease of modeling. When looking at transfers, an obviously important part of the decision is the cost of that transfer. With different universities, there are going to be different costs to the transfer. Depending on where the transfer is, it may come with a radically different cost. With Penn State, that situation is alleviated. Since all of the campuses are in Pennsylvania, it is easier to assume a constant transfer cost. Cost of living between the campuses is not as spread out as it could be if the campuses were spread all across the country. This makes modeling transfer costs much easier. The ease of using Penn State as a model for all college transfers is quite useful. Later on in this paper, the extent to which this can be extrapolated will be discussed.

Chapter 3

Literature Review

What decides how well students perform in a college setting? Obviously, there are a plethora of factors that include a student's ability level, what school they attend, what subject they are studying, and many more. Even who is sitting next to a person in class can determine their performance (Hong & Lee 2017). One important factor that can be looked at is a student's background. More specifically, whether or not a student comes from a low-income background or is a first-generation student. Toutkoushian showed that first-generation students and low-income students are interested in colleges. Furthermore, the colleges and institutions that they are interested in are the ones that closely match their ability level (1999). However, Katrevich and Aruguete have shown that first-generation college students exhibit lower scores and lower critical thinking skills than their peers (2017). Their study also showed a lower level of academic support and academic preparedness for college. It has been shown that a lower graduation rate among first-generation college students occurs at universities regardless of direct cost of schooling (Stinebrickner & Stinebrickner 2003). Stephens, Fryberg, et. al., also found through four different methods that there is a cultural difference between how first-generation and continuing-education students are raised. This leads to a difference in how these students handle the challenges of college education, which leads to lower performance (2012). Considering that low-income students also come from differing backgrounds than average students, it is safe to say that this could also affect them. This is referred to as "cultural mismatch," when students attend the wrong level of higher institution not necessarily due to not knowing their ability level,

but due to a fundamental misunderstanding of how college will work for them (Stephens, Fryberg, et al. 2012).

Much research has already been done on the subject of mismatch when it comes to college education. It occurs when a student who has low levels of innate ability attends a school that is selective and highly competitive (overmatch) or when a student with high abilities does not attend such a school (undermatch). Mismatch has occurred, on average, to 41% of students. Although these numbers have gone down, mismatch is still something that occurs fairly frequently (Smith, Pender, and Howell 2013). Both Cooper and Liu and Dillon and Smith found that educational mismatch is not massively determined by gender or race. Rather, they found that mismatch is caused by the preferences of the student, the proximity of the school, and, to a smaller degree, the wealth of the parents (Cooper and Liu 2016, Dillon and Smith 2013). However, none of these analyses looked at transfers. Transfers could be a logical response is there is mismatch as to preferences, proximity, or wealth. Although this analysis does not examine educational mismatch, it does take those factors into account.

Bringing these reasons for mismatch up is important. This analysis is going to focus on Penn State, a school that his massive in Pennsylvania. Furthermore, all of the campuses are within the borders of Pennsylvania. What this means is that if a student desires to go to Penn State, their preferences are going to lead them to go to whichever campus matches their ability best. Because all of the campuses are Penn State campuses and there are many campuses for many different preferences of students, the effect of preferences is mitigated. Furthermore, there are campuses all over Pennsylvania, with University Park centrally located. This implies that geography will not have as large of an effect on mismatch.

None of these studies focus on what was discussed above as cultural mismatch. The wealth of the parent does have an effect on mismatch, but these studies focus on wealth as a continuous variable. Cultural mismatch would focus on low-income and/or first-generation students. These are dichotomous variables, so looking at cultural mismatch will be using different methods for quantifying wealth than the studies above.

Another set of effects that this analysis will look at is the effect of transfers. Are students who transfer from one school to another going to be better off in the long run? The issue here is that there is not a lot of research into the economics or the motivations behind transfers. In order to delve into this, an assumption will have to be made. At the end of each semester, a student has the choice to stay at the school they are in, transfer to another, or drop out. If a student is properly matched in their school, then they will stay. If not, they will either transfer or drop out. Students who drop out of school are likely to do so because they have discovered their academic abilities. They believe that staying is not worthwhile (Stinebrickner and Stinebrickner 2014). If a student is not doing well in school and discovers that they can transfer to a school that better matches their abilities, then it follows that they will be more likely to do that than to drop out. This rests on two assumptions. The first assumption is that a student would rather have a college degree than not have a college degree. Considering the employment and wage benefits that a degree grants, this makes sense. The second rests on the Penn State ecosystem. It is assumed to be far easier to transfer from one Penn State campus to another than it is to transfer from one Penn State campus to an entirely different school. With this ease, students are much more likely to do that than to drop out.

Educational mismatch comes down to three main factors: geography, preferences, and wealth. Focusing on Penn State allows this analysis to mostly ignore those three factors.

Furthermore, transfers are far easier in the Penn State ecosystem, meaning that transfers are easier than dropouts for students. Further on in this analysis, this will be used to formulate a model that can quantify the effects of cultural mismatch as a result of a student being low-income or a first-generation student. This would not be feasible without the assumptions that can be achieved by focusing on one university with many campuses such as Penn State.

Chapter 4

Theory Model

Once it is decided that the analysis will utilize Penn State as the only university system in this hypothetical world, there remains only three options. The first is to immediately begin working and eschew college. The second is to attend a Penn State Commonwealth Campus, and the third is to attend Penn State's University Park campus. With this assumption, a student's choices and payoffs can begin to be calculated. At first, a two-period model of education is utilized as a simple vehicle to explain the necessary parameters. Once the option for transfer in the third period is added, the θ values that separate students is recalculated. This will be used along with other values in a simulation of 100 hypothetical students whose goal is to match Penn State's reported values of attendance, transfer, and dropout.

A Two-Period Model

This analysis begins by utilizing a two-period model. This serves two purposes. The first is a simple environment to explain the parameters that appear in the final simulation. These can be explained in an easier, theoretical sense in a two-period model. Later, the three-period model adds in the option to transfer. The second purpose is for calculations. The initial ability values that separate a student from choosing one of their three options in period one are calculated in the two-period model. The two-period version is explained below.

In this world where it is assumed students only have three choices of what to do after high school, the first option is to not attend a Penn State campus. With those who decide to not attend college, the equation of their returns is simple:

$$Y = W_1 + \frac{W_2}{R_2}$$

Where Y is total income over the two periods, W_1 is the wage in period one (which is the present), W_2 is the wage in period two (which is in the future) and R_2 is the real gross interest in period two, which discounts the wage in period two into current values.

If someone decides to attend college at Penn State's University Park campus, their returns are as follows:

$$Y = (W_1(1 - \bar{e}) - p_{UP}) + \frac{W_2 h_{UP}(\bar{e})\theta}{R_2}$$

Attending college at a Penn State Commonwealth campus will return the following:

$$Y = (W_1(1 - \bar{e}) - p_{CC}) + \frac{W_2 h_{CC}(\bar{e})\theta}{R_2}$$

These two equations are very similar, so they will be explained together in the following. Income over the two periods, wage, and real gross interest are marked in the same way as above. Time spent focusing on school is marked as $\bar{e}$. This is an assumption that students at both types of campuses will focus on school, on average, the same amount of time. There will be students who are part time, working, or in non-degree programs at both types of campuses. The tuition for the different types of campuses is given by p_{UP} and p_{CC}. Barring any scholarships or other types of financial aid, p_{UP} will be greater than p_{CC}. This assumes that, on average, schooling will be more expensive at the University Park campus.

The second period for both universities is very similar when it is written in this unspecified form. The only term that is different between the two equations in the second period is $h_{UP}(\bar{e})$ and $h_{CC}(\bar{e})$. This is the return to human capital that comes from attending both University Park and Commonwealth Campuses. That is the increase in skill and ability that

attending a university will impart. In this case, it is assumed that $h_{UP}(\bar{e})$ is going to be greater than $h_{CC}(\bar{e})$, meaning that students from the University Park campus develop their human capital to a higher extent than Commonwealth students. That leaves only the term θ, which is each student's innate ability level.

Calculating θ

The value of θ that each student has is their ability level, but also things such as how well their talents match to college. This is unique to each student. When setting the payoff equations from the two-period model equal to one another, then the θ that separates a student from attending a Commonwealth Campus or attending the University Park campus can be calculated. Similarly, this same method can be used to find the θ that separates those who attend a Commonwealth Campus from those who decide instead to begin working. These values are reported below, along with the rest of the parameters.

The method of calculating θ for students is straightforward. The formula for this calculation is below.

$$\theta = (\varepsilon * 0.6) + .22$$

Each student is different, so each student begins with a different number First, a random number is generated from between 0 and 1. That value is given by ε. The range of this random number is shrunk to account for the wide range of values possible relative to the distance between the θ values that differentiate the two types of campuses. Then, a constant is added to all of these numbers to make sure that students do not have a θ of 0, which would mean zero

innate ability, which could not occur. An individual value is assigned to each student in the simulation.

θ Reassignment

After students have made their initial choices about where to attend college, they move on to the second period where they make a decision about whether or not to transfer. But first, they must receive a new θ value. As will be seen below, the inclusion of third period between the initial choice and the lifetime earnings allows for a modification that cannot be accounted for before the decision in period one.

The first period remains the same in the three-period model. The second period is where students must decide whether to transfer to a different campus or to leave college altogether. This can be attributed to a student finding out their θ after attending a program that, through grades and assignments, is built on informing students of their abilities. This does not account for students who find out that they perform better or worse in a college system as opposed to high school. There are a multitude of reasons that the θ that is assigned to a person in period one may not continue to be their θ forever. For this reason, when students discover their true θ, it will be slightly different than their originally assigned θ. There is also an assumption that this will occur in different capacities at different campuses. Because of a different environment, different professors, and different expectations, students will have their θ value adjusted by different amounts. The new θ will be marked as θcc for students attending Commonwealth Campuses and θup for students attending the University Park campus. For calculating purposes, θcc will be as follows.

$$\theta cc \;=\; \theta + ((\mathcal{E} - 0.5) * (.1387 * 5))$$

In this case, $\mathcal{E}$ is a random number between 0 and 1. This number is subtracted by half to give students an equally likely chance to realize that their true θ is higher or lower than originally thought. This value is then multiplied by a value made up of the difference in the θ cutoffs between the two campus types, which is multiplied to give a large possibility of new θ values. These numbers were chosen because shifts in θ should be thought about in terms of the difference between the two types of campuses and because there is a wide range of results that students attending a Commonwealth Campus can attain. Since Commonwealth Campuses and University Park are different programs and have different cultures, the formula used for University Park and for University Park will be different. The formula to calculate θup is as follows:

$$\theta up \;=\; \theta + ((\mathcal{E} - 0.2) - (.1387))$$

Like above, $\mathcal{E}$ is a random number between 0 and 1. The difference in this case is that it is only subtracted by a smaller amount. The data shows that there is a lower rate of dropout and transfer for University Park students, leading to an assumption that students are less likely to have a true θ that is lower than their initial estimation. This value is subtracted by, the difference between the θ values that divide the two campuses. This is due to the way that the model is being made. If a student is to drop out, their value of θ needs to drop below the critical value separating work and a Commonwealth Campus. This subtraction ensures that an event like that can occur.

The Three-Period Model

Now that the initial decision of schooling or work has been made and the θ values of each person has been updated, the full calculations can be extrapolated. For those who work from the beginning, their lifetime income across the three periods are as follows:

$$Y = W_1 + \frac{W_2}{R_2} + \frac{W_3}{R_3}$$

The only change from the previous equation is the addition of the third period, meaning there is W_3, which is the wage in period three, and R_3, which is the real interest in period three.

For those that stay in their respective campuses, the equations are simple as well. For University Park, it is as follows:

$$Y = (W_1(1 - \bar{e}) - p_{UP}) + (W_2(1 - \bar{e}) - p_{UP}) + \frac{W_3 h_{UP}(\bar{e})\theta up}{R_3}$$

For those who stay at a Commonwealth Campus, their lifetime incomes are as follows:

$$Y = (W_1(1 - \bar{e}) - p_{CC}) + (W_2(1 - \bar{e}) - p_{CC}) + \frac{W_3 h_{CC}(\bar{e})\theta cc}{R_3}$$

These, as above, have not changed much in the movement from two periods to three periods. The only change is that the second period is now one where students are paying and their income is postponed to period three. These students have much more straightforward educational path, and their calculations are likewise straightforward.

For students transferring from University Park to a Commonwealth Campus, their incomes are given as follows:

$$Y = (W_1(1 - \bar{e}) - p_{UP}) + (W_2(1 - \bar{e}) - p_{CC} - F) + \frac{W_3 h_{CC}(\bar{e})\theta up}{R_3}$$

Where F is the cost of transferring from one campus to another. Likewise, the students who transfer from a Commonwealth Campus to University Park have a lifetime earning of:

$$Y = (W_1(1 - \bar{e}) - p_{CC}) + (W_2(1 - \bar{e}) - p_{UP} - F) + \frac{W_3 h_{UP}(\bar{e})\theta cc}{R_3}$$

This is similar to the students who stay at their original choice of campus. The differences come from the cost of transferring from one campus to another, the change in prices from the new campuses, and the differences in the human capital function that comes from the differences in campuses.

Similar to above, there will be a point when someone's θ is low enough that they decide to drop out of school. However, they will likely not enter the workforce in the same capacity as someone who entered the workforce without attending any higher education programs. Part of the reason for this is that a student will have learned what their θ value. For this reason, a student's prospective earnings function if they are to drop out of a Commonwealth Campus is:

$$Y = (W_1(1 - \bar{e}) - p_{CC}) + (W_2(1 - \hat{e}) - p_{Oth.}) + \frac{W_3 h_{Oth.}(\hat{e})\theta}{R_3}$$

Similarly, there is a point where someone would drop out of University Park, which is given by the following:

$$Y = (W_1(1 - \bar{e}) - p_{UP}) + (W_2(1 - \hat{e}) - p_{Oth.}) + \frac{W_3 h_{Oth}(\hat{e})\theta}{R_3}$$

This is consistent with someone who attends university, and then drops out to pursue some other career choices. Their time spent in education has changed from $\bar{e}$ to $\hat{e}$, which signifies that they are spending their time differently than they were when they were at school. Their p and h functions have likewise changed to reflect the fact that they are paying the cost and receiving the benefits of some other type of program. The is almost impossible to measure.

Students who drop out could have an ê and p of zero, and yet still receive some form of positive h. Whereas p is public information given by Penn State and h and ē for Penn State can be averaged, there is almost no way to do that for students who drop out of school. For this reason, students who drop out will receive wages as if they did not attend college from the beginning. They will still pay the cost of college in the first period, however.

When these equations are set equal to one another, the differences in θ that separate each of the initial choices can be found. These results are reported below in Table 1.

Methods

In order to find the parameters needed for this simulation, the estimated results had to match the actual results. In order to do this, it needed to be determined how many students would not be attending college and would instead begin working. By utilizing data from the NCHEMS Information Center for Higher Education Policymaking and Analysis, the proportion of students attending college immediately after graduating from a Pennsylvania high school can be found. The reason for using this exact amount is explained in Chapter 5. From there, using the 2008 Cohort Generation and Income Status Report, it can be found how many of the remaining students will attend a Penn State Commonwealth Campus or Penn State's University Park campus. This can be adjusted to find the number of students in the 100-student simulation that would be expected to choose each option. Utilizing the same methods, the number of students who can be expected to transfer from one choice to another in the second period can also be found.

Once that information is found, each student's θ is calculated to determine their initial placement. The θ function is adjusted along with the proportional costs of schooling to ensure that the results of the simulation match up with the results given by Penn State. Then, the θ reassignment function and the H function are adjusted to ensure that the transfer rates also line up with reality. Once the values of the simulation match up with the values given by Penn State, total income can be calculated and calculations focusing on first-generation and low-income students can be performed. The parameters used to line up the simulation are reported below.

Parameters

All parameters used are listed in Table 1 below, with an explanation following.

Parameter	Value
Critical θ – Work and Commonwealth Campus Critical θ – Commonwealth Campus and University Park	0.43955775 0.57817177
Wage in Period 1 (W_1) Wage in Period 2 (W_2) Wage in Period 3 (W_3)	1 1.4 1.96
Tuition at University Park (p_{UP}) Tuition at Commonwealth Campus (p_{CC})	0.4 0.3
Real Gross Interest – Period 2 (R_2) Real Gross Interest – Period 3 (R_3)	1.01 1.02
E ($\bar{e}$)	0.8
H function of $\bar{e}$ – University Park (h_{UP}) H function of $\bar{e}$ – Commonwealth Campus (h_{CC})	4.3 4
Cost of Transferring (F)	0.1

Table 1: Parameters

The parameters above show the other data, besides θ, that are used in the simulation. The first box is the wages. 1, 1.4, and 1.96 were chosen with the assumption that wages would rise with a worker's experiences. The difference between W_1 and W_2 is arbitrarily chosen. The difference between W_2 and W_3 is a result of squaring W_2. This ensures that wages continue to rise, but there is consistency in the difference of the three periods.

The prices of tuition at Penn State are numbers that can easily be found on their website. However, this analysis is not looking at money in terms of thousands of dollars, but in a more

theoretical idea of money and earnings. In this simulation, prices are normalized to W_1. As such, p_{UP} is 0.4 and p_{CC} is 0.3. The reason for these numbers is that the cost of college, averaged over the two periods that one would attend school, would be a sizeable portion of one's potential income. A value of 0.4 was chosen for University Park students, and because Commonwealth Campuses are cheaper, their prices are slightly lower at 0.3.

The real gross interest rates, R_2 and R_3, were chosen as 1.01 and 1.02. These increase with every period to normalize costs and wages back to present day dollars. In this case, it is assumed that the real gross interest rate in period one (a theoretical R_1) would be 1. Since this would be lost in any calculations, it is not used. Then, each period, the rate goes up by a constant of 0.01.

The amount of time that a student spends in school-related activities, such as attending class or completing assignments, is their e. Due to the way that this model is constructed, there can be one e for students, and that is ē. For the purposes of this, it is assumed that ē is 0.8. This means that on average, students attending university spend 80% of their waking time actually performing school-related tasks.

Related to ē is the H function of ē. This is the amount that one person gains to their overall perceived skill level as a result of attending Penn State. Because ē is assumed to be the same for all students, the way that this is differentiated is through having one for University Park and one for the Commonwealth Campuses. The Penn State ecosystem as a whole is a well-known, respected university system. As such, the Commonwealth Campuses have an H function of 4.0. Because the University Park campus is the largest campus and has more opportunities for its students, its value is slightly higher at 4.3.

Lastly, there is a cost of transferring. For students who decide to transfer, it is not free. There is the cost of moving as well as personal costs that are inherent in changing which campus one is attending. As such, the value of F is 0.1 to reflect this.

All of these values were used in a simulation of 100 students who have the choice between working, going to a Commonwealth Campus, or University Park. At first, the intention was to make the values of the simulation as close to the real reported values as possible. Those results are reported in the next section.

Chapter 5

Results

The results of this analysis were compared to data in Penn State's 2008 Cohort Generation and Income Status Report. This tracked all of the students who began their schooling at Penn State in the summer or fall of 2008 and eventually finished within six years. Much information is contained in this report, such as graduation rates, number of students who have transferred from one campus to another, and all of that broken down based on background. In the beginnings, the point was to get the values of the simulation as close as possible. Later on, more concrete conclusions were drawn based upon this data.

As a result of utilizing the 2008 Cohort Generation and Income Status Report, the values that the above model gives are extremely close to the actual rate given by the report. In order to do this, certain assumptions needed to be made. The first is that this report focuses on college students who attend college immediately after high school that graduated from high school in Pennsylvania. This assumption seems as though it is going to be extremely limiting, but it is not the case. None of the above model focuses on a person's background. The closest that it comes to that is their θ, which is randomly found. The reason that this assumption needs to be made is that it helps to choose the exact rate breakdown between students going to college. Using the NCHEMS Information Center for Higher Education Policymaking and Analysis' data, the rate of students from Pennsylvania going directly to college after high school in 2008 is 63.9% (College Participation Rates…). Without making this assumption, it would be extremely difficult to find the exact rate of students who do not go to college, which is integral to this analysis. Also, it

must be assumed that someone in this simulation has only three choices after high school. They can go directly into the workforce, which 36.1% of them will do. The other 63.9% of students will attend either Penn State University Park or a Penn State Commonwealth Campus. With those assumptions and the data that has already been given, the results can be reported.

	# of Students (Model)	Rate of Attendance (Model)	Rate of Attendance (Real)
No College	37	.37	.361
University Park	31	.31	.305
Commonwealth Campus	32	.32	.334

Table 2: Initial Placement Results

The above results were achieved by calculating the number of students who chose each of the three possible paths in the second period. This is the sheer number of students who attended each program without factoring in transfers that occur later. This is consistent with the information from Penn State. Their calculations of dropout rates and transfer rates did not take into account the total amount of students. Below are the calculations of the transfer and dropout rates among all students.

	# of Students (Model)	Rate of Transfer/Dropout (Model)	Rate of Transfer/Dropout (Real)
University Park transferring to Commonwealth Campus	3	.03	.01
Commonwealth Campus Transferring to University Park	9	.09	.13
University Park Dropout Rate	4	.04	.04
Commonwealth Campus Dropout Rate	14	.14	.15

Table 3: Transfer/Dropout Results

The above chart was calculated utilizing the same methods as above, but the way that the real rate of transfer and dropout were calculated differs slightly. In Table 2, they are calculated simply utilizing the rates that Penn State gives and the rates that the NCHEMS gives. For Figure 3, the rate is more complicated. The real rate used in Table 3 is actually the probability that a student in this simulation will fall into the assigned category. For instance, for students transferring from a Commonwealth Campus to University Park, one would expect 13% of all

students to fall into that category. In the simulation, that equates to 13 students following that exact transfer path.

Furthermore, this model utilizes random numbers multiple times in the calculation of θ, both at the beginning of the simulation and toward the middle. As such, the numbers will not always be exactly what the data from Penn State show. This reflects an uncertainty in this data that was provided by Penn State. The fact that there are human decisions being made means that there will be variance in the rate of transfer and dropout for Penn State. This model gave the best approximation that it can given the inputs.

What exactly are the outcomes given by a student transferring? The results are given in the tables below, and discussion follows. Student lifetime earnings outcomes were measured by two metrics. The first is based on initial placement. The second table looks at earnings based on transfers and history. Both are given for comparison.

Initial Placement	# of Students	Total Earnings	Average Earnings
No College	37	159.385168	4.30770724
University Park	31	207.055062	6.47047069
Commonwealth Campus	32	108.661405	3.50520662

Table 4: Earnings Based on Initial Placement

As can be seen in the table above, University Park students have the highest average earnings, followed by individuals who did not attend college, with Commonwealth Campus students in last place. On average, students who complete school at a Commonwealth Campus earn more than the group who did not go to college, but due to the high dropout rate, this does not show in the average earnings.

Transfer/Dropout History	# of Students	Total Earnings	Average Earnings
University Park to Commonwealth Campus	3	9.81170959	3.27056986
Commonwealth Campus to University Park	9	45.4015625	5.04461805
University Park Drop	4	4.08627451	1.02156863
Commonwealth Campus Drop	14	15.7019608	1.12156863
University Park Stay	24	167.226711	6.96777963
Commonwealth Campus Stay	9	30.6523686	3.40581873

Table 5: Earnings Based on Transfer History

The massive gap between the different groups is shown here. As could be expected, students who drop out have the lowest average earnings. Interestingly, students who go to a Commonwealth Campus and stay there are shown to have lower average earnings than those who don't attend university at all. The best choice for a student is to attend University Park and stay there, while attending a Commonwealth Campus and transferring to University Park is the second best choice.

Chapter 6

Examining Low-Income and First-Generation Students

This brings the focus of the analysis to low-income and first-generation students. In the beginning, the discussion around these two groups focused on if they were experiencing cultural mismatch. Cultural mismatch could manifest itself in multiple ways. The most obvious way would be differences among these groups. Four important rates need calculated. The first is the rate that students transfer from University Park to a Commonwealth Campus, and the second is the opposite, or students transferring from Commonwealth Campuses to University Park. The third and fourth important rates are the dropout rates for University Park and Commonwealth Campuses. If there is truly a difference in the way that low-income and first-generation students are matched in their choices for university, one would expect significant differences between the students who are a part of those groups and students who are not. The ways that these differences would manifest is a significant difference in the four rates listed above between low-income and first-generation students. The results are listed below. They are in terms of percentage of total students, or how many students would be expected to fall into each category in the 100 student simulation.

Transfer/Dropout History	All Students	Low-Income	Not Low-Income	First Generation	Not-First Generation
University Park to Commonwealth Campus	.01	.01	.013	.011	.013
Commonwealth Campus to University Park	.013	.0147	.0129	.0147	.0117
University Park Dropout	.04	.038	.039	.038	.045
Commonwealth Campus Dropout	.15	.0257	.0846	.225	.113

Table 6: Transfer Rates Based on Background

Are the differences in transfer and dropout rates between the different campuses and different groups of students significant? In this calculation, instead of using the modified rates that calculate how many students would be expected to be seen in the simulation, this calculation uses the raw rates given by Penn State. The significance tests are listed below.

Transfer/Dropout History and Background	Difference	P-Value	Significant?
University Park to Commonwealth Campus: Low-Income vs Not Low-Income	.0165	.09894	No
Commonwealth Campus to University Park: Low Income vs Not Low Income	.0078	0	Yes
University Park to Commonwealth Campus: First Generation vs Not First Generation	.0251	.30772	No
Commonwealth Campus to University Park: First Generation vs Not First Generation	.0030	0	Yes
University Park Dropout Rate: Low Income vs. Not Low Income	.104	0	Yes
Commonwealth Campus Dropout Rate: Low Income vs not Low Income	.096	0	Yes
University Park Dropout Rate: First Generation vs Not First Generation	.089	0	Yes
Commonwealth Campus Dropout Rate: First Generation vs. Not First Generation	.073	0	Yes

Table 7: Significance Results of Background Differences

As can be seen above, all of the differences are significant except the differences between groups in the University Park to Commonwealth Campus transfer rate. For that reason, those groups will be excluded from the calculations below.

The idea of the following calculations is that students from low-income and first-generation students come from different backgrounds. As such, when they attend college and reach the second period, they will have had different experiences than the average student. What they will have learned about the college experience and their own abilities will be different. As

such, the θ reassignment function for those students will be different than the one for the average students. In order to find out, the simulation will be rerun with a different θ reassignment function in order to make the different rates match what the simulation shows.

The graduation rate for low-income students from Commonwealth Campuses is an astonishing 46.4%. That means there is an estimate dropout rate of 53.4%. If this were true of all students at Commonwealth Campuses, 25 or 26 students would be expected to drop out of a Commonwealth Campus. Considering that Penn State's data shows around 15 students dropping out of the Commonwealth Campuses, this is a huge difference. Keep in mind that the original estimate of students to attend the Commonwealth Campus was 33. The new reassignment function is as follows.

$$\theta cc = \theta + ((\mathcal{E} - 0.9) * (.1387 * 5))$$

This reflects the difference in rate between the students who are low-income and the average students. The weight change on Ɛ reflects that there is a higher chance that a student will find out that their beliefs about school were not what they anticipated. That could mean that they were not aware of their own abilities to a higher degree or it could mean that they were not aware of all of the aspects that school entails.

The other group that shows a major difference from the average is the rate of students who drop from Commonwealth Campuses who are first-generation students. The dropout rate of first-generation students is 49%. If every student at the Commonwealth Campuses in the simulation was a first-generation student, then 22 or 23 students would be expected to drop out. In order to make the model match this, the new reassignment function is below.

$$\theta cc = \theta + ((\mathcal{E} - 0.85) * (.1387 * 5))$$

This is similar to what is seen above with the new reassignment function for Commonwealth Campus students who are low-income. The effect on the dropout rate for Commonwealth Campus students is less severe for first-generation students than for those who are low-income. This is reflected above with the weight on ε. What this implies is what whatever cultural mismatch effects are happening for low-income students are less pronounced for first-generation students.

What is interesting is that no other categories of students require this treatment. This may seem counterintuitive because, as seen above, there are significant differences in most of these groups. The only group where there should be no differences between the average students and low-income or first-generation students is the University Park to Commonwealth Campus transfer rate. That does not mean that there is a problem in the data, but rather a quirk in the model. The difference between average, low-income, and first-generation students in the model is quite small. Although the difference in real life is significant, when running the model multiple times, there are occasions when the simulation would unintentionally match up with the rates for low-income or first-generation students.

Chapter 7

Discussion of Results

After running a simulation in a hypothetical universe where 100 students can only go to work, go to Penn State's University Park campus, or one of Penn State's Commonwealth Campuses, there is consistency with what was expected. Students at University Park had the highest earnings, followed by students who transferred from another campus to University Park. Considering the university has a program where they encourage students to attend a Commonwealth Campus before transferring, this makes sense. What is very surprising is that students who stay at a Commonwealth Campus have lower average earnings than students who go right to work. This could be that students with very low θ values stay at a Commonwealth Campus, as opposed to transferring to University Park. On the other hand, it is hard to imagine that the difference would be so drastic, leading to the idea that it might be an issue with the model.

There was a difference between what was seen in the average student body and what was seen in first-generation and low-income students. This is what would be expected based on the cultural mismatch idea. Cultural mismatch would mean that the low-income and first-generation students would have different rates of transfer and dropout than what Penn State is witnessing from average students. But, that was not the case for all of Penn State. Students transferring from University Park to Commonwealth Campuses showed no significant difference in the rates of transfer no matter what their background was.

This was not what was expected. Cultural mismatch theory was found to be valid at universities of all types. These institutions pushed middle class modes of thinking, which led to first-generation students having much more difficulty in acclimating to university (Stephens,

Fryburg, et al, 2012). Why would it not hold for one specific type of student doing one specific type of transfer? Originally, it was thought that University Park and the Commonwealth Campuses had a difference in the way that students learned about their own ability levels in more ways than reassignment functions. It was thought that students at Commonwealth Campuses learned more about themselves than students at University Park. This would mean that students at Commonwealth Campuses would drop out and transfer at a higher rate, which is observed to be true. Once coupled with the idea of cultural mismatch, the observations that students who have low-income or first-generation backgrounds also transfer and drop out at a higher rate would mean that those students at Commonwealth Campuses would drop out at a much higher rate. That is also observed to be true.

Problems with this arise due to the fact that University Park students who transfer to Commonwealth Campuses show no significant difference in rates regardless of background. University Park students do show significantly higher dropout rates if they have a low-income or first-generation background. There are no real reasons inside of this simulation that could cause that. There could be something at Penn State that keeps first-generation and low-income students from transferring to Commonwealth Campuses when they would potentially fit there better. However, whatever program or cultural pressure is causing this is not preventing low-income and first-generation students from dropping out of University Park.

Where the analysis did yield results were in the changed reassignment functions. The difference in the reassignment functions for low-income and first-generation college students essentially guarantees that those students at Commonwealth Campuses will end up with a θ value that is lower than the initial θ. Those students realize that either their ability level is not a high as they expected or that their expectations of school in general were not true. The fact that

after transfers and dropouts, a total of only nine students remain at the Commonwealth Campuses shows that there is something to this. Of course, there is a program (called the 2+2 Program) that pushes students to attend a Commonwealth Campus for two years before attending University Park. The 2+2 Program also means that students attend school with the possibility of transferring in mind. The program would explain a lot of the transfers to University Park, but not necessarily all of the dropouts. That could be explained by cultural mismatch, but the other Penn State schools do not support this.

Chapter 8

Conclusion

Transfers between universities have not been studied extensively, but they are a topic that deserves extensive examination. As this simulation shows, a student transferring to another university could end up significantly increasing their lifetime earnings, even though there is a cost to transferring. This simulation made many unrealistic assumptions, and focused entirely upon Penn State, but there are conclusions that can be drawn from this still. The first is that transferring can be beneficial. Students who are mismatched or are at universities that are not right for them will be much better off by transferring to one that is than they would be by dropping out. It would be unrealistic to expect every university to have the ease of transfer that Penn State has between its campuses, but universities encouraging transfers in lieu of dropping out could be beneficial. This would be especially true for first-generation or low-income students whose rates of dropping out and transferring are much higher than that of all students. The simulation also showed that low-income and first-generation students have much different reassignment functions when they are at school than all students. This shows the need for more university understanding of what students experience when they arrive at university for the first time, as they might be coming from a background that needs support.

That leads to another suggestion by this paper: cultural mismatch deserves deeper examination as well. University Park students showed the same level of transfer, regardless of background. There could possibly be programs of systems in place at Penn State to facilitate the retention of students, but that should also apply to students who are considering dropping out of school. If cultural mismatch is to hold water, then schools should have significant differences in

what happens to low-income and first-generation students. Situations like this beg for further examination, because there could be something that is spoiling these results.

In the end, this paper shows that universities can offer students from low-income or first-generation backgrounds more support. Doing so may help dropout rates between these groups lower. Encouraging transfer to universities that match ability levels can be vital. Understanding what happens to students, especially from these backgrounds, whey they arrive at college can be more important. A more rigorous simulation or experiment could be run in the future to more concretely prove this.

References

Attewell, P. A., & Lavin, D. E. (2009). Passing the torch: does higher education for the disadvantaged pay off across the generations? New York: Russell Sage Foundation.

Belley, P., & Lochner, L. (2007). The Changing Role of Family Income and Ability in Determining Educational Achievement. Journal of Human Capital, 1(1). doi:10.3386/w13527

College Participation Rates: College-Going Rates of High School Graduates - Directly from High School. (2016). Retrieved Febrauary 18, 2018, from http://www.higheredinfo.org/dbrowser/?year=2008&level=nation&mode=data&state=0&submeasure=63

Cooper, R., & Liu, H. (2016). Money or Grit? Determinants of Mismatch by Race and Gender. Working Paper.

Dillon, E. W., and J. A. Smith (2013): "The Determinants of Mismatch Between Students and Colleges," Working Paper.

Geiman (2017). Determinants of College Attendance and College Graduation With a Focus on Family Transfers. Working Paper.

Hong, S. C., & Lee, J. (2017). Who is sitting next to you? Peer effects inside the classroom. Quantitative Economics, 8(1), 239-275. doi:10.3982/qe434

Katrevich, A. V., & Aruguete, M. S. (2017). Recognizing challenges and predicting success in first-generation university students. Journal of STEM Education : Innovations and Research, 18(2), 40-44. Retrieved from

http://ezaccess.libraries.psu.edu/login?url=https://search-proquest-com.ezaccess.libraries.psu.edu/docview/1927819584?accountid=13158

Keane, M. P., & Wolpin, K. I. (2001). The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment. International Economic Review, 42(4), 1051-1103.

Knapp, L. G., Kelly-Reid, J. E., & Ginder, S. A. U.S. Department of Education. (2010). Enrollment in Postsecondary Institutions, Fall 2008; Graduation Rates, 2002 & 2005 Cohorts; and Financial Statistics, Fiscal Year 2008 (NCES 2010-152). Washington, DC: National Center for Education Statistics.

Smith, J., Pender, M., & Howell, J. (2013). The full extent of student-college academic undermatch. Economics of Education Review, 32, 247-261. doi:10.1016/j.econedurev.2012.11.001

Stephens, N. M., Fryberg, S. A., Markus, H. R., Johnson, C. S., & Covarrubias, R. (2012). Unseen disadvantage: How american universities' focus on independence undermines the academic performance of first-generation college students. Journal of Personality and Social Psychology, 102(6), 1178. Retrieved from http://ezaccess.libraries.psu.edu/login?url=https://search-proquest-com.ezaccess.libraries.psu.edu/docview/1019437486?accountid=13158

Stinebrickner, R., & Stinebrickner, T. (2014). Academic Performance and College Dropout: Using Longitudinal Expectations Data to Estimate a Learning Model. Journal Of Labor Economics, 32(3), 601-644.

---. (2003). Understanding Educational Outcomes of Students from Low-Income Families: Evidence from a Liberal Arts College with a Full Tuition Subsidy Program. The Journal of Human Resources, 38(3), 591-617. doi:10.2307/1558769

Toutkoushian, R. K. (2001). Do parental income and educational attainment affect the initial choices of New Hampshires college-bound students? Economics of Education Review, 20(3), 245-262. doi:10.1016/s0272-7757(99)00052-7

Academic Vita

Jacob Foose
JakeFoose@psu.edu

Education

The Pennsylvania State University | Schreyer Honors College Class of May 2018
University Park, PA

- College of the Liberal Arts | Paterno Fellows Program
- B.S. Economics | B.A. Political Science
- Department of Economics Student Marshal 2018

Universiteit Maastricht | Center for European Studies Spring 2017
Maastricht, Netherlands

- Politics, Law, and International Relations | School of Business and Economics

Thesis

Matching Models: How Penn State's Campus Ecosystem Fits Economic Predictions
Thesis Supervisor: Russell Cooper, Professor of Economics

Honors and Activities

Schreyer Honors College Class of May 2018
Honors Student

- Researched and wrote original thesis
- Upheld rigorous GPA requirements all semesters
- Completed 45 credit-hours of honors-level courses

Penn State SHOTIME December 2015-August 2016
Team Leader (Entertainment)

- Designed and organized SHOTIME, the Schreyer Honors College's three-day orientation
- Led meetings with group of 20 mentors and planned how to execute SHOTIME activities
- Planned and performed in own events as well as contracted outside groups

Penn State Songwriter's Club August 2014-May 2018
THON Chair

- Designed events for the club to raise money for Penn State's THON
- Organized and perform in events around State College for Lion Ambassadors and THON
- Assisted other music clubs in planning events for charities and community outreach

Work Experience

Healthy Democracy-Portland, OR June 2016-August 2016
Nevins Fellow

- Assisted in organization and planning of Oregon's Citizen's Initiative Review (CIR)
- Utilized information from various states to write a report on the future expansion of the CIR
- Met with outside organizations, such as Kitchen Table Democracy, to develop the CIR

Grants Received

Schreyer Honors College Travel Grant

- Summer 2016 for internship in Portland
- Spring 2017 for study abroad

Nevins Fellowship

- Summer 2016 for internship in Portland

Language Proficiency

Conversational proficiency in German
Elementary proficiency in Dutch