

# **Research Dependence Theory Analysis of Higher Education Institutions in Uzbekistan**

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**Abstract:** In this paper “Resource Dependency Theory” (RDT) is used to guide an empirical analysis of the higher education system in Uzbekistan. Regression analysis is applied to a panel dataset consisting of 62 Uzbek higher education institutions, covering the period 2000-2013, to examine the determinants of the expenditure decisions made by institutions. The key hypothesis is concerned with the relationship between the share of revenue from tuition fees and the share of expenditure spent on teaching. The analysis attempts to control for unobserved heterogeneity through the inclusion of fixed effects. Instrumental variables estimation is used to address the potential endogeneity of the relationship between these two variables. The main finding is that there is a positive and statistically significant relationship between the share of revenue from tuition fees and the share of expenditure spent on teaching, even after other factors are held constant, which is consistent with a core premise of RDT.

**Keywords:** resource dependence theory, higher education finance, Uzbekistan.

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## **Research Dependence Theory Analysis of Higher Education Institutions in Uzbekistan**

### **Introduction**

Following the breakup of the Soviet Union, Uzbekistan declared independence on August 31, 1991. Before independence, and like all other republics of the Soviet Union, almost all aspects of higher education were “centrally planned” in Moscow through the Ministry of Education. For example, decisions about subjects taught, student numbers, course content, staff salaries and student stipends were made by “Moscow-Central”. There was little, if any, serious consideration of any regional requirements or input from those working at higher education institutions. The inefficiencies inherent to central planning, that were the main factor behind the breakup of the Soviet Union, are well known, and such inefficiencies were present in the way resources were allocated to higher education. At the time of independence, Uzbekistan inherited a higher education system on the verge of collapse (see Ruziev and Rustamov, 2016).

The restructuring of the failed higher education system inherited from the Soviet Union has been a slow and expensive process for the Uzbek Government. Like most countries, the Government also had to reduce considerably expenditure on public services, including education, as a consequence of the most recent “financial crisis” (see Albrecht and Ziderman, 1995; Johnstone and Marcucci, 2010; Sanyal and Johnstone, 2011). One institutional response to reductions in government funding is to introduce some form of “user fee”, such as tuition fees. If user fees are already in place, another response is to increase the amount charged (Barr, 2010; Johnstone, 2004; Muscio et al., 2013; Salmi and Hauptman, 2006; Sanyal and Johnstone, 2011). Most research on consequences of introducing or increasing tuition fees has largely focused on the “demand-side”, which is mainly the impact on the behaviour of students such as participation and drop-out rates (Canning et al., 2007; Johnstone and Marcucci, 2010; Paulsen and Smart, 2001; Psacharopoulos and Partinos, 2004; Sam, 2011; Tilak, 2004). There has been little research on the “supply-side”,

which is the impact on the behaviour of institutions in terms of, for example, how revenue is partitioned between teaching, research and other activities.

With this brief background in mind, this paper has two main aims. The first is to use “Resource Dependency Theory” (RDT) to guide an empirical analysis concerned with how becoming more dependent on tuition fees as a source of revenue affects expenditure decisions about how this revenue is spent. We agree with Nienhuser (2008, p. 18) that “it is not possible to test such a complex theory like RDT in its entirety because it consists of many hypotheses”. However, it does suggest the key (for our purpose) hypothesis that if the relative share of one type of revenue increases then the relative share of expenditure relevant to this source should also increase. Given the growing dependency of higher education institutions in some countries on tuition fee income, RDT is a useful starting point before moving on to more elaborate theoretical explanations of institutional behaviour. The second aim is to provide what we believe is the first empirical analysis of this type for a former Soviet republic. In addition, we believe Uzbekistan makes an interesting case study since it has had to restructure a centrally-planned higher education system concurrently with the rolling out of market-economy.

The remainder of this paper is organised as follows. Section 2 is a historical overview of the higher education system in Uzbekistan since independence. A key trend since around the year 2000, is that the share of public funding has declined considerably with the share of private funding increasing considerably against a backdrop of increasing student numbers. Section 3 is a brief review of RDT. The small number of studies that have used RDT to guide empirical research concerned with the behaviour of higher education institutions are reviewed. The methodological approach is presented in Section 4. Regression analysis applied to a panel data set consisting of 62 Uzbek higher education institutions, covering the period 2000-2013, is used to examine the possible determinants of the share of expenditure spent on teaching. The main hypothesis is that this share should be highly dependent on the share of revenue from tuition fees. The analysis attempts to control for unobserved heterogeneity through the inclusion of fixed effects.

Instrumental variables estimation is used to address the potential endogeneity of the relationship between the share of revenue from tuition fees and share of expenditure spent on teaching. Results are presented in Section 5. Conclusions follow in Section 6. The main finding is that there is a positive relationship is positive and statistically significant, even after other factors are held constant, which is consistent with a core premise of RDT.

## **2. An Overview of Uzbek Higher Education System**

In 1991, Uzbekistan inherited a higher education system consisting of 42 institutions. There were three “state universities”, nine engineering polytechnics, fourteen teaching and language colleges, three agricultural colleges, three cultural and arts institutes, seven medical, nursing and pharmaceutical schools and one sports and physical education institute (SCS, 2013). Since independence, the number of higher educational institutions has increased to 64. “New” institutions were created by opening, reclassifying, renaming and merging institutions. There are currently two “academies”, 21 universities and 41 “institutes”. Academies are research-intensive institutions that offer mainly post-graduate programmes of study. Most of the universities teach a wide-range of subjects at both the under-graduate and post-graduate levels. “Institutes” tend to be more specialised institutions. The key point is that in the 25 years since independence, there has been considerable change in the Uzbek higher education system. Not only has the number of institutions increased by 50 per cent, there has also been considerable restructuring.

The Uzbek higher education system is the responsibility of the Ministry of Higher, Specialised and Secondary Education (MHSSE). All the physical assets of higher education institutions (e.g. buildings and land) are state-owned. It is important to note that at the time of independence, the Government committed the country to free-market principles. Despite this pledge, the higher education system remains partially controlled by the Government. However, compared to the Soviet Union higher education system, institutions are much more self-determining, having scientific and management boards that make operational decisions.

Institutions are permitted to manage their physical assets. For example, they are allowed to keep income generated from the rental of property, such as student accommodation. They are also allowed to keep income generated from commercial activities such as consulting and contract research.

The Government, through the Ministry of Higher, Specialised and Secondary Education, sets the maximum number of students that an institution can enrol through a set of subject-specific quotas. Figure 1 shows the number of students enrolled in the academic years 2000/2001 to 2016/2017. The figure also shows the numbers separately for under-graduate and post-graduate study. Note that the post-graduate numbers are for masters-level students and do not include doctoral/PhD students. In this seventeen year period, the number of students increased from 183,600 in 2000/2001 to 268,300 in 2016/2017. This is an increase of 84,700 students, which in percentage terms represents an increase of nearly 50%, and an average growth rate of around 3% per year. The majority of this growth has been in under-graduate study rather than post-graduate study. In the academic year, 2016/2017, 96.5% were under-graduate students and 3.5% were post-graduate students. In this period, the share of post-graduate students has never exceeded 5.2%. It is clear that in this period there has been a sizeable expansion in the number of students enrolled at Uzbekistan higher education institutions

<<<< Figure 1 About Here >>>>

Figure 2 shows the numbers of students admitted in the academic years 2000/2001 to 2016/2017. Again the numbers are shown separately for under-graduate and post-graduate study. The pattern is similar to what is observed for enrolment, noting that enrolment is a “stock” while admission is a “flow”, so in absolute numbers, the former is considerably larger than the latter. In the academic year 2000/2001, 44,700 students were admitted, of which 90.8% were under-graduate admissions and 9.2% were post-graduate admissions. In the academic year, 2016/2017, 61,200 students were admitted, of which 94.3% were under-graduate admissions and 5.7% were

post-graduate admission. In other words, about 40% more students were admitted in 2016/2017 compared to 2000/2001. Post-graduate admissions, as a share to total admissions, have almost halved. It is important to note that admissions peaked at almost 70,000 in 2007/2008. Since, then admissions declined slightly, stabilising around 63,000 per year in the period 2008/2009 to 2016/2017.

Figure 3 shows the numbers of students graduating in the academic years 2000/2001 to 2016/2017. The numbers graduating is also a “flow”. There has been a large increase in the number of graduates in this seventeen year period. In the academic year 2000/2001, there were 31,600 graduates of whom 89.2% were under-graduate graduates and 10.8% were post-graduate graduates. In the academic year, 2016-2017, there were 64,100 graduates of whom 91.6% were under-graduate graduates and 8.4% were post-graduate graduates. This indicates that the numbers graduating in 2016/2017 is about double that of 2000/2001. More specifically, under-graduate graduates increased from 28,200 in 2000/2001 to 58,733 in 2016/2017, which in percentage terms is a difference of 108%. Likewise, post-graduate graduates increased from 3,400 in 2000/2001 to 5,367 in 2016/2017, which in percentage terms is a difference of 58%.

<<<< Figure 3 About Here >>>>

Beginning in the mid-2000s, institutions were allowed to set their own tuition fees subject to a “cap” set by the Ministry of Higher, Specialised and Secondary Education. Currently 70% of under-graduate students and 80% of post-graduate students are required to pay tuition fees. The remainder have their tuition fees paid by the Government. These students are mainly from disadvantaged backgrounds and certain ethnic groups. Table 1 shows the annual average tuition fees for under-graduate and post-graduate study for selected subjects in the academic year 2016/2017. There is not much variation in tuition fees between under-graduate and post-graduate study. The average tuition fee paid for under-graduate study is \$USA2,606 per year and for post-graduate study \$2,852 per year. Likewise, there is not much variation by subject studied. The

standard deviation for under-graduate study is \$400 and for under-graduate study \$450. Tuition fees of around \$2,800 do not seem excessive when compared to the United States or the United Kingdom. However, Uzbekistan is classified by the World Bank as a “lower middle income” country. In 2016, the average individual earnings in Uzbekistan was \$1,625 per year. Therefore, tuition fees averaging above \$2,800 per year represent a considerable expense. Higher education is very expensive in Uzbekistan and is a serious financial burden for the majority of students and their families.

<<<< Table 1 About Here >>>>

Not only are tuition fees high in Uzbekistan, they have increased considerably in real terms, particularly in the past decade. Figure 4 shows the average tuition fees paid for under-graduate and post-graduate study in the period 2000/2001 to 2016/2017 in real 2016 USA dollars. In this same period, there was considerable inflation with the Consumer Price Index (CPI) increasing around seven fold (i.e. in 2017, 7 Uzbekistani So'm had the same purchasing power as 1 So'm in 2000). Inflation was rarely less than 10% per year and was over 25% per years in 2000 and 2001. As Figure 4 shows, tuition fees actually decreased in real terms from 2000/2001 to 2007/2008. However, since then tuition have risen steadily from around \$1,000 for under-graduate study and \$1,100 for post-graduate study to \$2,600 and \$2,850, respectively. This represents an average annual increase in both under-graduate and post-graduate tuition fees of around 12% per year.

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Considering changes in real tuition fees removes the problem associated with inflation. However, real values say little about the Uzbekistan's population “ability to pay” these fees. In order to understand this better, Figure 5 shows the ratio of tuition fees to average annual individual earnings. Even in 2000/2001, higher education in Uzbekistan was expensive, with tuition fees being equivalent to around one year's average individual earnings. In the earlier years of this period, this ratio increased, suggesting that tuition fees increased more than average earnings.

However, after this period, the opposite occurred, with the ratio decreasing to around the equivalent of around one year's average individual earnings by 2007/2008. Since then it increased, and has been relatively constant in recent years at around 1.6 times average earnings for undergraduate study and 1.8 times average earnings for post-graduate study.

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One might expect that with such increases in tuition fees and student numbers, expenditure per student would have increased. Figure 6 shows expenditure per student for five academic years: 2000/2001, 2003/2004, 2007/2008, 2011/2012 and 2012/2013. Such information is regarded as being sensitive by the Government and we were unable to find estimates for any other years. However, fitting a trend line (shown in Figure 6) through these five observations for the period 2000/2001 to 2016/2017 provides some evidence that expenditure per student has decreased in this period. In the academic year 2000-2001, expenditure per student was \$532. In the academic year 2012/2013, it was \$475. This represents a reduction of around 10%.

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As a partial response to the increasing tuition fees, in 2001 the Government introduced a stipend system for all students, regardless of whether they were paying tuition fees themselves or having the fees paid by the Government (NHDR, 2011). The Government justified their "stipends-for-all" policy on equity grounds, in the sense that it resulted in all students having a minimum income to pay the costs of at least a part of their study. However, the amount of the stipend received depends on academic performance, with better performance translating into a larger stipend. In the academic year, 2016/2017, there were three stipend levels based on grades received: (1) "excellent" = \$188 per month (2) "good" = \$141; and (3) "satisfactory" = \$94 (MFUZB, 2018). Since the stipend for "excellent" is double that for "satisfactory", the stipend system is also an incentive system aimed at improving academic performance. It is worth noting that 12 months of the top stipend is only two-thirds of the average tuition fee. There is a



considerable shortfall between the cost of a year's study and what the stipend system pays. We know of no research that has explored whether this stipend system is actually working.

Figure 7 shows the number of academic staff in the period 2000/2001 to 2016/2017. It is clear that the number of academic staff has steadily increased, noting that in the same period the number of higher education institutions also increased. In 2000/2001, the number of academic staff was 21,640. By 2016/2017, this had increased to 27,014 academic. This is an increase of almost 5,500 people or 25%. About 8% of current academic staff are Professors and Doctors of Science; around 38% are Assistant Professor and Candidates of Science and around 54% are Lecturers (MFUZB, 2018). Table 2 shows the average monthly salaries of different academic staff in the academic year 2013/2014. The maximum salary for a head of department is \$US715 per month. The minimum salary for an assistant is \$US462 per month. This is a salary gap between the “top and bottom” of around 50%, which is very small compared to what is observed in most Western countries (EC Tempus, 2010). However, as Figure 8 shows, the increase in academic staff has not resulted in an increase in the staff-student ratio. This ratio actually decreased from 2000/2001 to 2007/20008. Since then it has increased from around 80 to 100 students per staff member.

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Institutions in the Uzbek higher education system receive funding from both public and private sources. Before the start of the academic year, each institution prepares a budget, which is largely based on the previous academic year's funding plus any additional funding requests. The budget is then vetted by the Ministry of Higher Specialised and Secondary Education. After deliberation, the overall budget for the higher education sector is set and forwarded to the Ministry of Finance, who decide on the amount that will be allocated (which is usually less than what is asked for). Therefore public funding is essentially a “block grant”, with the institutions being able to spend this money in a way they desire. The main source of private funding is from tuition fees, along with rental income, consultancy, contract research and the provision of short courses and training to groups in both the public and private sectors. It is important to note that there is no

direct “clawback”, in the sense that private funding does not crowd out public funding. More specifically, if an institution raised an additional \$US1 million in private funding, its public funding through its block grant is not reduced by this amount or some fraction of it.

Figure 9 shows the funding shares of Uzbek higher education institutions for each academic year in the period 2000/2001 to 2016/2017. Three funding sources are included in this figure. The first is the share of income from tuition fee income. The second is the share of income from the government. The third is the share of income from other private activities such as consultancy, contract research and commercial activities. It is clear that the share from government has decreased in this period. In 2001/2001, 58.4% of income was from the government. By 2016/2017, this share had dropped to 28.5%. On the other hand, in the same period, the share of income from tuition fee income has increased from 38.1% to 68.4%. However, Uzbekistan higher education institutions have not been very successful at increasing their share of income from non-government/non-tuition fee sources. In 2000/2001, the share of income from other private activities was 3.4%. In 2016/2017 it was 3.1%. It has never exceed 4.1% in any academic year. Income from tuition fees is now the principal source of funding, making up over two-thirds of total income.

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### **3. Previous Research**

Resource Dependency Theory (RDT) is primarily concerned with how the behavior of an organization is affected by the external resources that the organization uses. The first comprehensive statement of RDT is by Pfeffer and Salancik (1978). Central to their interpretation is the idea that the control over the allocation of resources is an important source of power in organizations. (Pfeffer and Salancik, 1978, p. 39) state: “...the behaviors of organizations will respond to demand made by external organizations upon whose resources they are heavily dependent”. This simple idea makes intuitive sense in competitive markets, where a group of firms are producing a similar product using similar inputs and competing for the same customers. In

such markets, a firm's ability to obtain, change and exploit resources is fundamental to their success, if not their survival, in the market.

Organizations depend on resources, and some (if not all) of these resources are produced by other organizations. However, resources produced by one organization are only of value if they are used by another organization. This leads to a dependency between organizations, with the access to and control of resources becoming the basis of power. It is the distribution of power across organizations that is fundamental in explaining their behavior. Despite its simplicity, RDT has stood the test of time well, and remains a very influential theoretical framework in organizational behavior, industrial economics, supply chain management, managerial economics and other business-related subjects (see Hillman, Withers and Collins, 2009).

One of the first studies that analyses the resource dependence of one organization on another is Proven, Beyer and Kruytbosch (1980). They investigate the relationship between non-profit organizations and their umbrella organizations. Their main conclusion, which supports RDT, is that: "...power over an individual organization is larger the more resources it controls" (p. 18). Since this seminal empirical work, there have been a large number of studies that have attempted to understand the behaviour of a wide range of organisations testing hypotheses derived from RDT. Studies that represent this diversity well include: Boyd, (2006), Casciaro and Piskorski (2005), Davis and Cobb (2010), Freel (2000), Frooman (1999), Hillman, Shropshire and Cannella, (2007), Ozcan and Eisenhardt (2009) and Saidel (1991). There are also a small number of studies that have used RDT to understand the behaviour of institutions in the higher education sector. Since the focus of this paper is the higher education sector in Uzbekistan, the remainder of this section focuses on these studies.

We believe that the first empirical application of RDT-derived hypotheses to the higher education sector is Tolbert (1985). She constructed a sample of 167 public and 114 private universities in the United States. She finds that universities with a higher share of income from public sources have a larger number of offices that manage public-funding. Likewise she found

that universities with a higher share of income from private sources have a large number of offices that manage private funding. Both findings are supportive of RDT. Her analysis suggests that the more dependent a university becomes on a specific source of funding, the larger the share of resources devoted to obtaining such funding and the lower the share devoted to other activities.

In our view, the most comprehensive application of RDT to the higher education sector is Fowles (2013). He examines the relationship between a university's dependence on tuition fee income and their expenditure on teaching (and teaching-related activities). He constructed an 11-year panel of 419 "four year" public universities in the United States. The main outcome variable of interest is "teaching expenditure as share of total expenditure". A key explanatory variable is the "share of total operating revenues derived from net tuition". Net tuition revenue is total income received from tuition fees paid minus any scholarships, stipends or "fee deals", which effectively reduce the fees paid by students. RDT hypothesizes a "strong" positive association between these two variables. Regression analysis confirms such an association, even after other variables thought to impact of the outcome variable are "held constant".

One issue left unexplored, but of considerable policy importance, concerns whether increased expenditure on teaching actually has a positive impact on student performance, as measured by, for example, grades or drop-out rates. Coupet (2013) addressed this issue more directly employing a statistical approach similar to Fowles (2013). A notable finding is that an increasing share of administrative expenditure in total expenditure is associated with higher dropout rates in Afro-American universities in the United States. He argues that there is a need to reduce the administrative costs to reduce dropout rates of students studying at these universities.

Pilbeam (2012) tests features of RDT theory by considering the rolls of "Pro-vice Chancellors" (PVCs) in the United Kingdom higher education sector. Their approach is considerably different to the studies discussed above. A Pro-vice Chancellor is similar to a "Vice-president" in the American higher education system. A web-based survey was used to collect information from 16 universities. In each of these universities, the questionnaire was completed

by the Pro-vice Chancellor responsible for teaching and the Pro-vice Chancellor responsible for research. The main findings show that PVCs responsible for research had formed cross-institution communication networks to collectively lobby for public research funding controlled by the Funding Council. The PVCs responsible for teaching had not formed such networks. The likely reason being is that unlike research funding, there is no similar “pot” of teaching funding available to lobby or compete for.

It is difficult to precisely test specific hypotheses derived from RDT. With respect to higher education, the theory implies that if the share of funding from one source of revenue increases in its relative importance, then the share of expenditure relevant to this source should also increase. With respect to the Uzbek higher education system, there has been a large increase in the last 15 years in the share of revenue from tuition fees. Since it is believed that tuition fees are mainly a payment for teaching services, if RDT is an accurate explanation, then the share of expenditure spent on teaching should have also increased in this period.

## **4. Methodology**

### **4.1 Data**

In order to explore the relevance of Resource Dependence Theory, a panel data set of individual Uzbek higher education institutions was constructed covering the 14-year period 2000-2013. The main data source were the annual financial reports of the each higher education institution provided by the Ministry of Higher, Specialised and Secondary Education. Most of this information is not in the public domain. It is an unbalanced panel since in the period, “new” institutions were created by opening, reclassifying, renaming and merging institutions. In total, 62 institutions generated 857 institutions-year observations, with an average of 13.8 observations per institution.

### **4.2 Regression Model**

In an attempt to address hypotheses consistent with Resource Dependence Theory, variants of the following two-way fixed effects regression model are estimated:

$$ShareTeach_{it} = \alpha + \beta ShareFee_{it} + \gamma Controls_{it} + \theta_i + \theta_t + \varepsilon_{it} \quad (1)$$

where the subscript “*i*” ( $i = 1, 2, \dots, 62$ ) denotes institution and subscript “*t*” denotes year ( $t = 2000=1, 2001=2, \dots, 2013=14$ ). “*ShareTeach*” is the share of total expenditure of institution “*i*” in year “*t*” spent on teaching. “*ShareFee*” is the share of total revenue of institution “*i*” in year “*t*” from tuition fees. “*Controls*” is a set of variables for institution “*i*” in year “*t*” that capture factors thought to impact on expenditure decisions in addition to “*ShareFee*” (discussed below). “ $\theta_i$ ” is an institution-specific fixed effect, which is included to capture unobserved factors specific to institutions that persistently impact on expenditure decisions and do not change over time (i.e. unmeasured factors that affect individual institutions that do not change over time). “ $\theta_t$ ” is a time-specific fixed effect, which is included to capture unobserved factors that persistently impact on the expenditure decisions of all institutions over time (i.e. unmeasured factors that affect all institutions in the same way through time). “ $\varepsilon_{it}$ ” is a random error term. “ $\alpha$ ”, “ $\beta$ ” and “ $\gamma$ ” are the parameters to be estimated. The inclusion of both institution and time fixed effects is a way of attempting to control for unmeasured factors that should be included as variables in the regression. Although fixed-effects do not provide any information about what these factors are, their inclusion does allow one to interpret the effects of the variables included in the equation with greater confidence (see Baltagi, 2014).

If Resource Dependency Theory is relevant, then you would expect “ $\beta$ ”  $> 0$ . This would imply that the higher the share of revenue from tuition fees, the higher the share of expenditure spent on teaching, after other factors are held constant. In addition, since both “*ShareTeach*” and “*ShareFee*” are proportions, “ $\beta$ ” has a straight-forward interpretation. To illustrate, if “ $\beta$ ” = 1, then a one percentage point increase in “*ShareFee*” is associated with a one percentage point

increase in “*ShareTeach*”. If “ $\beta$ ”  $> 1$ , then a one percentage point increase in “*ShareFee*” is associated with more than a one percentage point increase in “*ShareTeach*”. If “ $\beta$ ”  $< 1$ , then a one percentage point increase in “*ShareFee*” is associated with less than a one percentage point increase in “*ShareTeach*”. Therefore, “ $\beta$ ” is effectively an “elasticity”, which is the standard way in which economists summarize the strength of the association between two variables. The larger the value of “ $\beta$ ”, the more responsive changes in the share of resources devoted to teaching are to changes in the share of revenue from tuition fees.

### **4.3 Variables**

The dependent variable in the regression model is the share of total expenditure spent on teaching (*ShareTeach*). This variable is the the amount of money spent on instruction, student services, as well as the spending on maintaining of the library and classroom facilities, as proportion of total expenditure. The largest component are salaries paid to academic and administrative staff, who do the teaching and carry out teaching-related administration. Unfortunately, we do not have information about how academic staff split their time between research, teaching and other activities. Therefore, we cannot be more detailed in the way “education expenditure” is measured. However, since all staff do not spend all their time teaching, “*ShareTeach*”, contains a certain amount of measurement error. Another important component of this variable is student stipends that all students receive based on their previous semester’s grades.

The main independent variable of interest is the share of total revenue from tuition fees (*ShareFee*). This variable is the tuition fee share of total operating revenue for public and private funding sources. Public funding is mainly from the block grant that each institution receives from the Government. Private income, other than tuition fees, includes rental income, campus services (such as catering), consultancy, contract research, short courses, training programmes and the sale of other educational products such as books and teaching materials.

The regression also includes four additional control variables. The first is institutional size (*NumStud*). Institutional size is a student-based measure, equal to the number of full-time equivalent students enrolled at each institute in each year. The majority of students at Uzbek higher education institutions are full-time students. In the construction of this variable, part-time students were allocated a weight of one-half (0.5) of full-time students.

The second control variable is the average tuition fee charged at each institution in each time period (*AveFee*) corrected for inflation. As discussed above, tuition fees vary across institutions and by subject. It is argued that tuition fees are in part a signal of institutional quality. Institutions that charge higher fees are often perceived to be higher quality institutions. For example, it is believed that individuals who attend such institutions received a better education. In turn, upon graduation, these individuals are likely to have more success in the labour market.

The third control variable takes into consideration that there are differences in tuition fees between under-graduate and post-graduate study, with tuition fees being higher at most institutions for post-graduate study (see Table 3). In attempt to control for this difference, a variable was constructed for each institution for each year consisting of the average duration (in weeks) of post-graduate programs (*LengthPG*). Albrecht and Ziderman (1995), Koshal and Koshal (1999) and Barr (2009), amongst others, have argued that the higher cost of post-graduate education can be partially offset by economies of scope in post-graduate and under-graduate education.

The fourth and final control variable is the number of staff at each institution in each year (*NumStaff*). This includes both academic and administrative staff. Since staff salaries is the largest item of expenditure for most institutions, you would expect expenditure decisions to be affected by staff numbers. It is important to note that since student numbers (*NumStud*) is also included as a variable in the regression, the empirical model is implicitly controlling for differences in the “staff-student ratio”. Therefore, if institutions decide to increase the number of staff in order to increase the staff-student ratio, then those institutions with a larger number of staff are more likely to have higher teaching-related expenditure.



#### 4.4 Endogeneity

The empirical model presented above explicitly assumes that the direction of causation is from the share of total revenue from tuition fees to the share of total expenditure spent on teaching. That is, changes in the share of total revenue from tuition fees cause changes in the share of total expenditure spent on teaching (i.e.  $\Delta ShareFee \rightarrow \Delta ShareTeach$ ). This is the causal direction implied by Resource Dependency Theory. However, the reverse casual direction is also plausible. For example, an institution may increase its share of expenditure devoted to teaching in order to send a signal to potential students that they provide high quality teaching. If they are successful, then the institution could charge higher tuition fees resulting in a large share of tuition fees in total revenue. The idea of potential two-way causation raises the possibility that the share of total revenue from tuition fees is “endogenous” (see Bowden and Turkington, 2007). Therefore, in our empirical model, the variable *ShareFee* is potentially endogenous. If this is the case, then not only will the estimated parameter of *ShareFee* ( $\beta$ ) be biased but likely also the estimated parameters ( $\gamma$ ) of the other included variables. It is important to stress that the inclusion of fixed effects is not a solution to the endogeneity problem.

In an attempt to address the potential endogeneity of the share of tuition fees in total revenue, an “instrumental variables” (IV) estimation approach is adopted (see Bowden and Turkington, 2007). In order apply IV estimation, at least one variable—the so-called “instrumental variable” —that generates exogenous variation in “*ShareFee*” is needed. In a strict sense, what is needed is a variable, “*Z*”, that is correlated with “*ShareFee*” and not correlated with “*ShareTeach*”. If this condition is met, then the relationship between “*ShareFee*” and “*ShareTeach*” can be purged of potential endogeneity, with the resulting estimated parameter of “*ShareFee*” being the causal effect of “*ShareFee*” on “*ShareTeach*”. From a statistical point of view, the technique is a form of two stages least squares regression. From a practical point of view, the IV estimation requires replacing “*ShareFee*” in Equation (1) with its predicted value based on a regression that includes all the other variables (“*Controls*”) and at least one addition variable

(i.e. the “instrument”) that is not included in Equation (1). As is discussed below, there are formal statistical tests that provide information on the validity of the underlying assumptions of this estimation technique.

Two instrumental variables are used. The first, “*DevFund*” is related to the so-called “Development Fund” (CMUZB, 1997). Starting in 1997 (i.e. before the time period used in our analysis), a policy was introduced where each higher education institution at the beginning of each academic year is required to deposit five per cent of their previous year’s revenue to a central fund controlled by Ministry of Higher, Specialised and Secondary Education. In most years, most institutions bid for money on a competitive basis from this fund, with wide variation in the amounts awarded. The second instrumental variable, “*AdAllow*” is related to the “Additional Admission Allowance”. This is essentially money received by institutions for enrolling students above their original quota at the request of the Ministry of Higher, Specialised and Secondary Education. We do not know how much each institution received. All we know is whether some money was received. Therefore, “*AdAdim*” is a dummy variable coded “1” if the institution received some money and coded “0” if they did not. This money is in addition to the tuition fees paid by these above-quota students.

It is clear that receiving money from these two sources increases the total revenue of an institution in the academic year it is received. However, it is not clear that it increases expenditure on teaching, since expenditure decisions are made in the previous academic year for the next academic year (e.g. the hiring of new staff). Therefore, we expect that *a priori* both should be good instruments. In order to explore the validity of this assumption further, two Durbin-Wu-Hausman test statistics were calculated. Both are tests for the exogeneity of “*ShareFee*” based on “*DevFund*” and “*AdAdmin*” as instruments. These tests are discussed in detail in Baltagi (2014) and Bowden and Turkington (2008). The first is the Durbin-Wu Hausman  $\chi^2$  statistic. This value of this test statistic is 8.4, which is highly statistically significant at  $p\text{-value} = 0.004$ . The second is the Durbin-Wu Hausman  $F$  statistic. This value of this test statistic is 7.7, which is highly

statistically significant at a  $p\text{-value} = 0.006$ . Both versions of the test clearly reject the hypothesis that “*ShareFee*” is exogenous. These tests indicate that ordinary least squares regression is not the appropriate estimator for Equation (1) and instrumental variables should be used.

## 5. Results

Table 3 reports the means, standard deviations and minimum/maximum values of all the variables used in the statistical analysis. The values are for all 62 institutors over the time period 2000-2013. About 80% of expenditure is on teaching. Around 55% of total revenue comes from tuition fees. Average institutional size is around 3,200 full-time equivalent students. Average number of staff per institution is 783. Average tuition fee paid is over 2 million Uzbekistani so‘m per year. The average length of a postgraduate course is 63 weeks. 89% institutions received “Additional Admission Allowance” funding. The average amount of funding per institution received for the “Development Fund” was nearly 2 billion Uzbekistani so‘m. The standard deviation and the minimum/maximum values shown in Table 5 suggest that there is considerable variation in all these variables.

<<<< Table 3 About Here >>>>

Figure 10 is a plot of the relationship between the share of revenue from tuition fee (*ShareFee*) and share of expenditure on teaching (*ShareTeach*). Given there are 857 points observed in this figure, there are not a large number of outliers. In addition, the majority of the observations are bunched quite tightly to the predicted relationship shown by the dashed-line. The zero-order correlation is +0.26, which is statistically significant at below the 1% level ( $p\text{-value} < 0.01$ ). This positive and significant statistical correlation is consistent with Resource Dependency Theory in the sense that a larger share of revenue from tuition fee is associated with a larger share of expenditure being spent on teaching. While this is encouraging, there are other factors that affect

expenditure decisions, and these need to “held constant” in order to more confidently comment on relative the strength of this relationship.

<<<<< Figure 10 About Here >>>>>

It is important to note that the minimum and maximum values for *ShareTeach* and *ShareFee* suggest that there are some institutions in the data-set that specialist institutions in the sense that they concentrate on research or teaching. The range in *ShareTeach* is wide, ranging from 16% to 98% with standard deviation is only 9.4% Likewise, the range in *ShareFee* is even wider, ranging from 6% to 95%, with a larger standard of 16.1%. Such institutions may be outliers, which could bias coefficient estimates. However, this is less likely to the case when fixed-effects regression is used. An outlier in our analysis is by definition an institution that has a large residual i.e. the difference between its actual values and the value “predicted” by the regression is large. Institutions that are outliers will have a large fixed effect. In fixed effects, outliers are in a sense “controlled for” and coefficient estimates should not be biased.

Table 4 reports the regression estimates. Column 1 are the ordinary least squares (OLS) estimates. The parameter of “*ShareFee*” is positive but very small in magnitude and is not statistically significant at the 10% level. Column 2 are the fixed effects estimates, where both institution-specific and time-specific fixed effects are added. In this specification, the parameter of “*ShareFee*” is positive. It is also about 10 times larger than in the OLS specification and statistically significant at the 1% level. Column 3 are the instrumental variable estimates. In this specification the parameter “*ShareFee*” is almost four times larger than in the fixed effects specification. However, it is only statistically significant at the 10% level. Finally, Column 4 are the fixed effects instrumental variable estimates. In this specification, the parameter of “*ShareFee*” is very similar in magnitude to the estimate from the IV specification (Column 3), but is statistically significant at the 5%

<<<<< Table 4 About Here >>>>>

Before turning to a discussion of the other variables included in the models, it is important to note that the inclusion of fixed effects leads to a large increase in the proportion explained. The  $R^2$  value for the OLS specification is 16.0%. Once institution-specific and time-specific fixed effects are added, the  $R^2$  value increases to 55.9%. Likewise, when fixed effects are added to the instrumental variables specification, the  $R^2$  value increases from 16.3% to 55.4%. This suggests that there are key factors that impact on the share of total expenditure spent on teaching not included in the specification. While these fixed effects “stand in” for these omitted variables, the estimator does not provide information about what these missing variables are. However, future research will need to seriously consider including other factors beyond those included in our specification.

The Durbin-Wu-Hausman tests reported above suggests that “*ShareFee*” is endogenous and that instrumental variable estimates should be used to estimate the model. Given that it is also important to include institution-specific and time-specific fixed effects, our preferred specification is what is reported in Column (4) of Table 6. Therefore, we have more confidence in the parameters of the control variables based on this specification compared to the other specifications. In this specification, three of the four included control variables are statistically significant at the 1% level. However, the magnitude of the effects are very small. The parameter of the number of students variable, “*NumStud*”, is negative. The parameter of the number of staff variable, “*NumStaff*”, is positive. The parameter of the average tuition fee paid, “*AveFee*”, is positive. Finally the parameter of the average length of postgraduate courses, “*LenghtPG*” is positive but not statistically significant. While there are various interpretations of the effects, the small estimated effects suggest that they are not important. For example, an additional 1,000 students is only associated with 0.012 reduction in the share of expenditure spent on teaching.

The key finding is the parameter of “*ShareFee*”. The point estimate of +0.343 suggests that a 10% increase in the share of revenue from tuition fees is associated with a 3.4% increase in share of expenditure spent on teaching. This implies that 10% increase in the share of revenue

from tuition fees is associated with a 6.6% increase in the share of expenditure spent on other activities. In other words, revenue for tuition fees include is heavily subsidising these other activities. It is not clear if this is sustainable.

One problem with the point estimate of 0.343 is that it is for the whole time period of 14 years. It is clear that fixed effects estimation with panel data is a useful estimator since it uses both cross-sectional and temporal variance. We believe this is preferred to estimators that are based only on cross-sectional variance or temporal variance. In order to explore if the parameter of “*ShareFee*” varies through time, two additional specifications are estimated. The estimates are shown in Table 5. In both specifications, an interaction between the share of revenue from tuition fees “*ShareFee*”, and a linear time trend, “*Year*” ( $2000=0, 2001=1, \dots, 2013=13$ ) is added. Column (1) shows the OLS estimates and Column (2) shows the fixed effects estimates. Strictly speaking in both specifications the interaction is not statistically significant. However, the parameter of interaction is negative. Ignoring statistical significance, and taking the point values as given, the parameter value for the year 2000 is 0.153 and 0.111 for the year 2013. In other words, the magnitude of the relationship is considerably smaller at the end of the period compared to the beginning of the period. However, it is not possible to do a similar calculation based on a specification that takes into consideration the potential endogeneity of “*ShareFee*”. If “*ShareFee*” is potentially endogenous then so is “*ShareFee x Year*”. In order to explore the potential endogeneity of both, you need more instruments than what we have in our dataset. Nonetheless, despite the very speculative nature of this finding, future research will need to examine carefully if the relationship between “*ShareFee*” and “*ShareTeach*” is time-varying, with it becoming less “elastic” through time.

<<<< Figure 5 About Here >>>>

## 5. Conclusion

This paper used “Resource Dependency Theory” (RDT) to guide an empirical analysis concerned with how the expenditure decisions of higher education institutions are affected when

they become more reliant on tuition fees. This analysis focussed on the experience of Uzbekistan. We believe Uzbekistan makes an interesting case study since it has had to restructure a centrally-planned higher education system concurrently with the rolling out of market-economy. In addition, the Uzbek higher education system had to adapt, like many other countries, to a sharp reduction in public funding related to the recent global economic recession. The main finding is that there is a positive and statistically significant relationship between the share of revenue from tuition fees and share of expenditure spent on teaching, even after other factors are held constant. Over the period 2001-2013, Uzbek higher education system have become much more dependent on tuition fees as a source of revenue. This trend is similar to what, for example, Fowles (2013), Slaughter and Leslie (1997) and Tolbert (1985) report for the United States. In this sense, the financial decisions made by Uzbek higher education institutions are similar to those made by public higher education institutors in the United States. This convergences is quite remarkably when it is remembers that at independence in 1991, Uzbekistan inherited a system riddled with the inefficiencies and dysfunctionalities associated with the collapse of central-planning and the disintegration of the Soviet Union.

To a certain extent it is not surprising that when students pay higher tuition fees, higher education institutions spend more on activities related to teaching. However, the analysis carried out in this paper suggests that this outcome in Uzbekistan is far from a “one-to-one match”. Our best estimate of the relationship between the share of revenue from tuition fees and share of expenditure spent on teaching is +0.34. This is considerably below the value of 1, which suggests that the majority share of tuition fee revenue is spent on non-teaching activities, such as research and administration. It is clear that Uzbek students (and likely their families) are heavily subsidising activities at higher education institutions that have little (if any) direct impact on the quality of the education experience they receive. This raises a serious value-for-money issue that cannot be ignored indefinitely by a government that periodically needs to democratically elected. Perhaps more importantly, given that the average tuition fee paid by Uzbek students is not drastically lower

than average earnings of Uzbek population, higher education is very expensive. Given average earnings, there seems little scope for making it even more expensive in the future, without sizeable reductions in participation rates and considerably political backlash

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<b>Table 1</b> <b>Average Annual Tuition Fees at Uzbekistan Higher Education Institutions,</b> <b>Academic Year 2016/2017, USA 2016 USA Dollars</b>		
<b>Subject</b>	<b>Under-graduate</b>	<b>Post-graduate</b>
Teaching	\$2,220	\$2,407
Arts	\$2,638	\$2,915
Humanities	\$2,220	\$2,407
Social Sciences	\$2,220	\$2,407
Journalism	\$2,421	\$2,654
Business and Management (economics)	\$2,938	\$3,225
International Economic Relations	\$3,289	\$3,616
Law	\$3,289	\$3,616
Natural Sciences	\$2,579	\$2,771
Engineering	\$2,528	\$2,816
All subjects	\$2,606	\$2,852
Source: MFUZH (2018)		

**Table 2**  
**Average Monthly Academic Salary, Uzbekistan,**  
**Academic Year 2013/2014**

<b>Position:</b>	<b>Monthly salary</b>
Head of Department	\$US682-715
Professor	\$US649-682
Associate Professor	\$US583-616
Senior Teacher	\$US528-550
Assistant	\$US462-495

Source: Author's calculations, based on data from MFUZH (2013) and the CB of Uzbekistan (2013)

**Table 3**  
**Summary Statistics of Regression Variables**

<b>Variable</b>	<b>Observations</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<i>ShareTeach</i>	857	0.80	0.094	0.16	0.98
<i>ShareFee</i>	857	0.541	0.161	0.06	0.95
<i>NumStud</i>	857	3,231	2,424	60	12,648
<i>NumStaff</i>	857	783	507	34	2,950
<i>AveFee(000)</i>	857	2,265	1,589	393	6,050
<i>LengthPG</i>	857	63	26	0	102
<i>DevFund (millions)</i>	857	1,995	2,420	0	13,209
<i>AdAdmin</i>	857	0.891	--	0	1

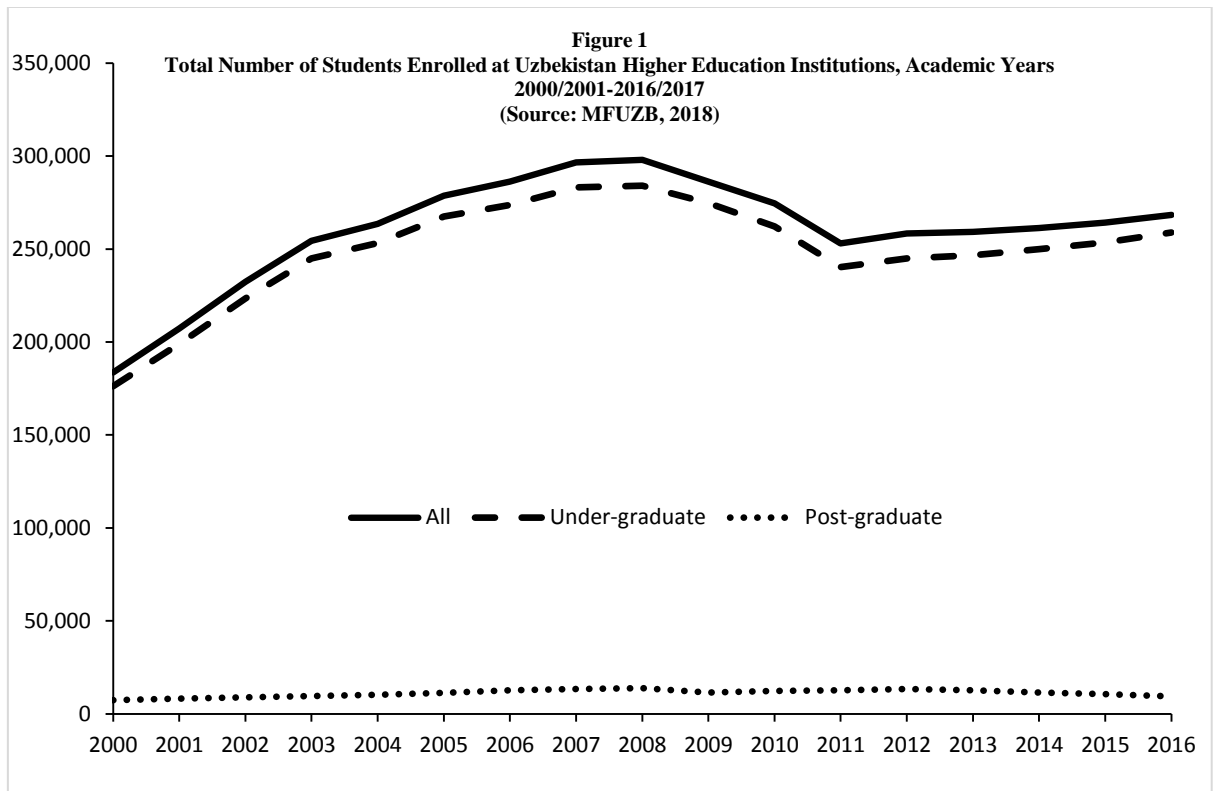
**Table 4**  
**Regression Estimates: Share of Total Expenditure Spent on Teaching (*ShareTeach*)**

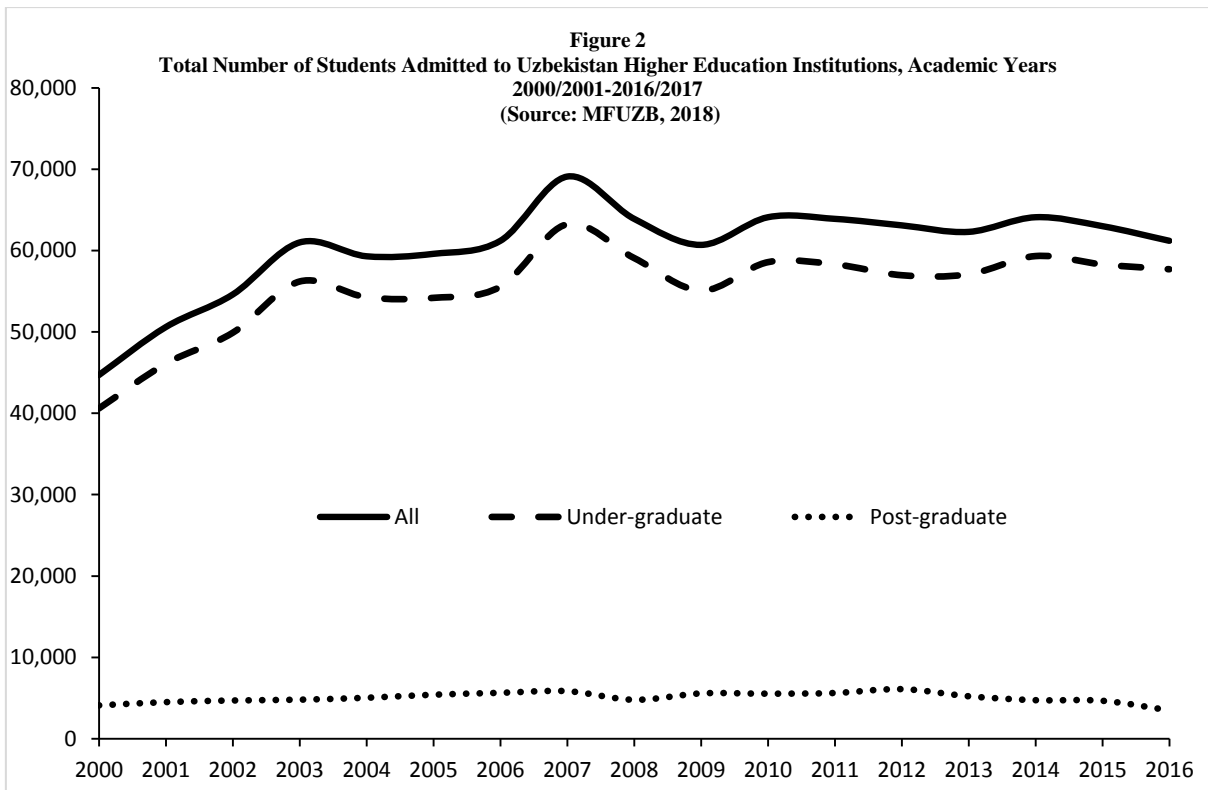
	(1)	(2)	(3)	(4)
<b>Estimator</b>	<b>OLS</b>	<b>Fixed effects</b>	<b>IV</b>	<b>Fixed effects-IV</b>
<i>ShareFee</i>	0.010 [0.4]	0.108*** [3.3]	0.375* [1.7]	0.343** [2.3]
<i>NumStud (000)</i>	0.007** [3.0]	-0.010*** [3.0]	-0.004 [0.6]	-0.012*** [3.0]
<i>NumStaff</i>	-0.00001 [1.2]	0.00007*** [3.4]	0.00004 [0.5]	0.0009*** [3.0]
<i>AveFee (000)</i>	0.00002*** [8.7]	-0.00003** [2.5]	0.00005 [0.3]	-0.00001 [0.6]
<i>LengthPG</i>	0.0003** [2.3]	0.0004* [1.9]	-0.0002 [0.6]	0.0003 [1.7]
<i>Constant</i>	0.717*** [61.8]	-0.767*** [17.9]	0.606*** [8.5]	0.589*** [2.9]
R <sup>2</sup> (%)	16.0%	55.9%	16.3%	55.4%
Institution fixed effects?	No	Yes	No	Yes
Time fixed effects?	No	Yes	No	Yes
N(observations)	857	857	857	857
N(institutions)	62	62	62	62

Notes: Absolute value of ratio of the parameter to its standard error given in parentheses: \*= significant at 10% level; \*\* = significant at 5% level; and \*\*\*=significant at 1% level

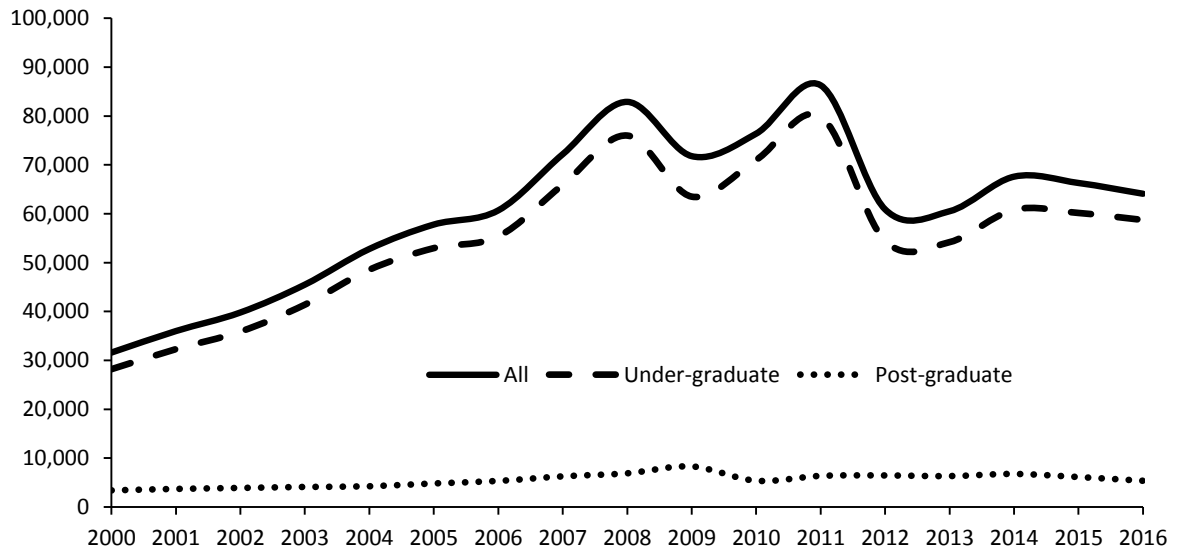


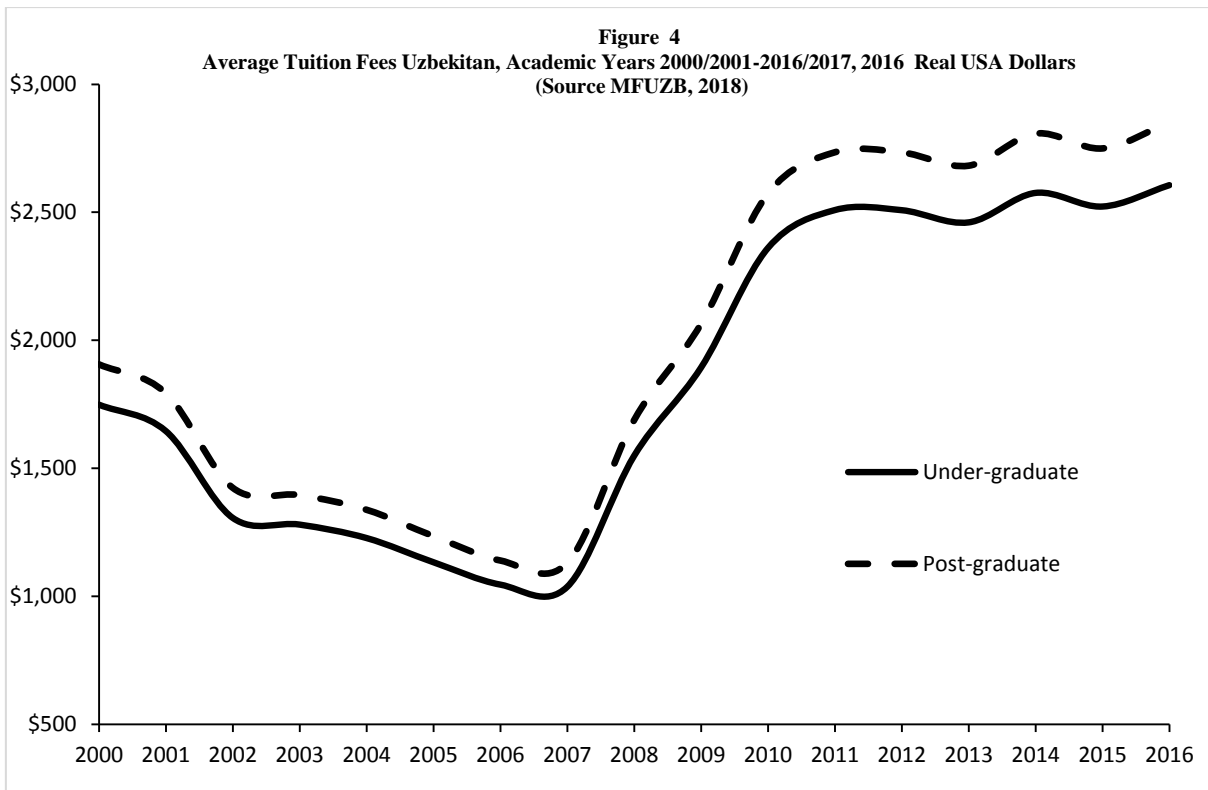
<p align="center"><b>Table 5</b>  <b>Additional Regression Estimates: Share of Total Expenditure on Teaching (<i>ShareTeach</i>)</b></p>		
	<b>(1)</b>	<b>(2)</b>
Estimator	<b>OLS</b>	<b>Fixed effects</b>
<i>ShareFee</i>	0.034 [0.7]	0.153*** [2.9]
<i>NumStud(000)</i>	0.009*** [3.3]	-0.006* [1.7]
<i>NumStaff</i>	-0.00004 [1.4]	0.0005*** [2.6]
<i>AveFee (000)</i>	0.00003*** [5.0]	0.0003 [5.3]
<i>LengthPG</i>	0.0003** [2.3]	0.0003 [0.9]
<i>ShareFee x Year</i>	-0.002 [0.4]	-0.003 [0.7]
<i>Year</i>	-0.003 [1.0]	-0.004 [1.4]
<i>Constant</i>	0.713*** [31.3]	--
R <sup>2</sup> (%)	16.3%	51.5%
Institution fixed effects?	No	Yes
Time fixed effects?	No	No
N(observations)	857	857
N(institutions)	62	62
<p>Notes: Absolute value of ratio of the parameter to its standard error in parentheses: *= significant at 10% level; ** = significant at 5% level; and *** =significant at 1% level</p>		

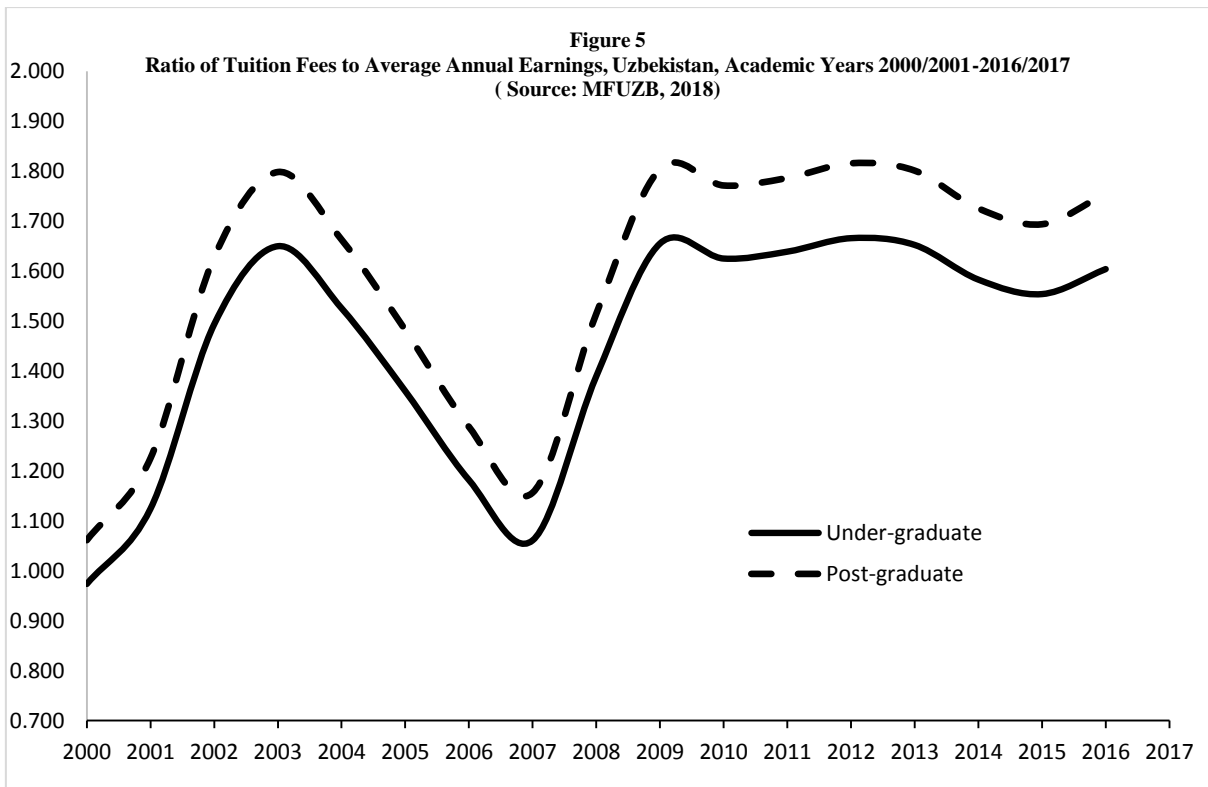




**Figure 3**  
**Total Number of Graduates from Uzbekistan Higher Education Institutions,**  
**Academic Years 2000/2001-2016/2017**  
 (Source: MFUZB, 2018)







**Figure 6**  
**Expenditure Per Higher Education Student, Uzbekistan, 2016 Real US Dollars**  
**Selective Years Academic Years Between 2000/2001-2016/2017**  
(Source: MFUZB, 2018)

