UNIVERSIDAD DE CÓRDOBA

FACULTAD DE DERECHO Y CIENCIAS ECONÓMICAS Y EMPRESARIALES

Departamento de Economía Agraria, Finanzas y Contabilidad

Programa de Doctorado: Ciencias Sociales y Jurídicas

TESIS DOCTORAL:

Ingresos estables por cobros de matrículas, pensiones y otros generadores de ingresos. Para inversión en infraestructura, investigación y tecnología en las Universidades Cofinanciadas de la provincia del Guayas.

Stable income from tuition fees, pensions and other income generators. For investment in infrastructure, research and technology in the Co-financed Universities of the province of Guayas..

Presentada por:

Mgtr. Argentina Lourdes Arias Barrionuevo, C.P.A.

Dirección: Dr. Juan Antonio Jimber del Río

Córdoba, septiembre de 2024

TITULO: *Ingresos estables por cobros de matrículas, pensiones y otros generadores de ingresos. Para inversión en infraestructura, investigación y tecnología en las Universidades Cofinanciadas de la provincia del Guayas*

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Memoria de tesis doctoral presentada por:

Mgtr. Argentina Lourdes Arias Barrionuevo, C.P.A.

DIRECTOR:

Dr. Juan Antonio Jimber del Río

Córdoba, septiembre de 2024

TÍTULO DE LA TESIS: Ingresos estables por cobros de matrículas, pensiones y otros generadores de ingresos. Para inversión en infraestructura, investigación y tecnología en las Universidades Cofinanciadas de la provincia del Guayas.

DOCTORANDO/A: Mgtr. Argentina Lourdes Arias Barrionuevo, C.P.A.

INFORME RAZONADO DEL/DE LOS DIRECTOR/ES DE LA TESIS

La tesis doctoral titulada "Ingresos estables por cobros de matrículas, pensiones y otros generadores de ingresos. Para inversión en infraestructura, investigación y tecnología en las Universidades Cofinanciadas de la provincia del Guayas", de la que es autora Argentina Lourdes Arias Barrionuevo, ha sido realizada bajo nuestra dirección y cumple las condiciones exigidas por la legislación vigente para optar al título de Doctor por la Universidad de Córdoba.

La presente tesis doctoral analiza el incremento de estudiantes en universidades privadas debido a la falta de cupos en las públicas ha llevado a un aumento en las pensiones en universidades privadas cofinanciadas del Guayas (ULVR, USCG y UPS) durante 2014-2018. Un estudio evaluó si este aumento mejoró la infraestructura y calidad de enseñanza, encontrando una relación positiva pero no significativa entre ingresos y gastos en inversión universitaria. Otro estudio analizó cómo los ingresos de universidades cofinanciadas influencian los salarios del personal académico y administrativo, descubriendo que aumentos en salarios académicos incrementan los ingresos universitarios, mientras que los aumentos en salarios administrativos los reducen. Finalmente, se investigó la influencia de los salarios del personal académico en el número de publicaciones científicas.

De la presente tesis se han derivado varias publicaciones científicas, que demuestran la capacidad del doctorando en el ámbito investigador:

- Barrionuevo, A. A., & del Río, J. A. J. (2023). Importancia de los ingresos en la inversión universitaria. Provincia de Guayas–Ecuador. Revista Venezolana de Gerencia: RVG, 28(104), 1735-1752.

  https://www.produccioncientificaluz.org/index.php/rvg/article/view/40898

  Índice de impacto del año de publicación en Scopus: Multidisciplinary: Q3

  - Índice SJR 2023: 0.23

Asimismo, se ha desarrollado investigaciones referentes a la temática, en la cual se evidencia en la participación de congresos internacionales:

- II Congreso Internacional y Multidisciplinar de Investigadores en Formación,organizado por la Universidad de Córdoba entre el 30 de noviembre y el 4 de diciembre de 2020.

Por todo ello, se autoriza la presentación de la tesis doctoral por compendio de publicaciones.

Córdoba, 8 septiembre de 2024

Firma del director

Dr. Juan Antonio Jimber del Río

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Agradezco a Dios por concederme sabiduría y entendimiento para cumplir mis metas profesionales, y a mis padres por ser un pilar fundamental en cada etapa de mi vida; ya que han sido mi motivación para continuar con mis estudios, y desarrollar investigaciones científicas que aporten al Ecuador y América Latina.

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Dedicada a todas aquellas personas que forman parte de este camino de investigación que aportaron a través de sus consejos y palabras de aliento, y me han motivado para fortalecer mi grado académico, y ser un mejor ser humano.

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RESUMEN

El propósito principal de las instituciones de educación superior es la formación integral de profesionales, y una relación comúnmente explorada en este ámbito es la entre el aumento de las tasas de matrícula y la demanda de educación superior. En Ecuador, la Constitución de 2008 y la Ley de Educación Superior de 2010 transformaron la financiación y administración de las universidades públicas, aumentando la regulación y rendición de cuentas. Estas reformas llevaron a la mejora de muchas instituciones públicas y al incremento de alumnos inscritos. Sin embargo, también generaron un crecimiento notable en la demanda de educación superior privada, incrementando significativamente los ingresos de estas universidades. En Guayaquil, universidades cofinanciadas como la UPS, la ULVR y la UCSG vieron incrementos en sus ingresos, lo cual fue esencial para la inversión en infraestructura, tecnología e investigación.

Los recortes de fondos en la educación universitaria pública han incrementado las tarifas de matrícula en las instituciones privadas, impulsando sus ingresos. Las universidades enfrentan el desafío de equilibrar su misión dual de enseñanza e investigación, ya que la evaluación del desempeño ha favorecido tradicionalmente los indicadores de investigación, marginando la enseñanza. La priorización de la investigación para obtener financiamiento y altos rankings ha fortalecido esta tendencia, creando un sesgo hacia estrategias centradas en la investigación y afectando la creatividad en la enseñanza. Ecuador ha aumentado su producción científica, ocupando el sexto lugar en América Latina y el Caribe en publicaciones Scopus, impulsado por un nuevo marco de políticas públicas que enfatiza la formación académica, la investigación, la innovación y la resolución de problemas alineados con los objetivos de desarrollo del país.

El objetivo de esta tesis es analizar el efecto de los ingresos en las universidades cofinanciadas en los salarios del personal administrativo y académico, y el número de publicaciones. El Capítulo 1 examina si el aumento de ingresos entre 2014 y 2018 mejoró la infraestructura y la calidad de la enseñanza, enfocándose en tecnología e investigación. El Capítulo 2 investiga cómo los ingresos de estas universidades influyen en los salarios del personal académico y administrativo, evaluando los cambios en la modalidad de trabajo y sus impactos en la calidad educativa. El Capítulo 3 analiza el efecto de los salarios académicos en la cantidad de publicaciones científicas, destacando el incremento significativo de la producción científica en Ecuador y su impacto en la investigación y el desarrollo.

ABSTRACT

The main purpose of higher education institutions is the comprehensive training of professionals, and a commonly explored relationship in this area is that between the increase in enrollment rates and the demand for higher education. In Ecuador, the 2008 Constitution and the 2010 Higher Education Law transformed the funding and administration of public universities, increasing regulation and accountability. These reforms led to the improvement of many public institutions and an increase in student enrollment. However, they also generated a notable growth in demand for private higher education, significantly increasing the revenues of these universities. In Guayaquil, co-funded universities such as UPS, ULVR and UCSG saw increases in revenues, which were essential for investment in infrastructure, technology and research.

Funding cuts in public university education have increased tuition fees at private institutions, boosting their revenues. Universities face the challenge of balancing their dual mission of teaching and research, as performance evaluation has traditionally favored research indicators, marginalizing teaching. The prioritization of research for funding and high rankings has strengthened this trend, creating a bias towards research-centered strategies and affecting creativity in teaching. Ecuador has increased its scientific production, ranking sixth in Latin America and the Caribbean in Scopus publications, driven by a new public policy framework that emphasizes academic training, research, innovation and problem solving aligned with the country's development objectives.

The objective of this thesis is to analyze the effect of income in co-funded universities on the salaries of administrative and academic staff, and the number of publications. Chapter 1 examines whether the increase in revenues between 2014 and 2018 improved infrastructure and teaching quality, focusing on technology and research. Chapter 2 investigates how the income of these universities influences the salaries of academic and administrative staff, assessing changes in work modality and their impacts on educational quality. Chapter 3 analyzes the effect of academic salaries on the number of scientific publications, highlighting the significant increase in scientific production in Ecuador and its impact on research and development.

General Index

Introducción general

Introducción general

El principal propósito de las instituciones de educación superior es la formación integral de profesionales (García & Villegas, 2019). Un tema comúnmente explorado en la educación superior es la relación entre el aumento de las tasas de matrícula y la demanda de educación superior (Havranek, Irsova, & Zeynalova, 2018). En este contexto, se puede afirmar que el incremento en las tarifas de matrícula conduce a un aumento en los ingresos de las instituciones educativas superiores.

En Ecuador, cambios significativos han dado forma al panorama de la educación superior en los últimos años. La Constitución de 2008 estableció la gratuidad de la educación pública para los ciudadanos ecuatorianos, lo que resultó en un cambio fundamental en la financiación y administración de las universidades públicas. Pasaron de ser instituciones con matrícula paga y relativa autonomía a depender completamente del gobierno central para la asignación de presupuesto, admisión de estudiantes y administración general (Avilés, 2016).

Un cambio fundamental fue la aprobación de la Ley de Educación Superior en agosto de 2010. Esta legislación tenía como objetivo aumentar la regulación y la rendición de cuentas de las universidades locales, alineando sus esfuerzos con las necesidades económicas y sociales del país. Se crearon tres instituciones nacionales para supervisar las instituciones de educación superior, aprobar nuevos programas, regular la admisión de estudiantes, distribuir fondos estatales, fomentar la investigación y acreditar programas académicos y universidades (Chávez, 2018).

La Ley Orgánica de Educación Superior (LOES) fue fundamental en la revolución de las políticas académicas en Ecuador. Exigió la creación de una entidad de acreditación para garantizar el cumplimiento institucional e introdujo regulaciones que rigen las actividades académicas y la jerarquía de las instituciones de educación superior. Esto llevo a la mejora de muchas instituciones de educación superior publica, además del incremento de alumnos inscritos en estas (Johnson, 2017).

Sin embargo, en los últimos años, la demanda de educación superior privada en Ecuador ha experimentado un notable crecimiento, generando un aumento significativo en los ingresos de las universidades privadas. Este cambio refleja un problema en la oferta y demanda de estudios superiores, por lo que para garantizar la calidad de la educación y maximizar los beneficios tanto para las instituciones como para la sociedad, es fundamental analizar cómo estas universidades gestionan sus recursos financieros.

Para el caso de la ciudad de guayaquil, las universidades cofinanciadas más destacadas incluyen la UPS, la ULVR y la UCSG, que experimentaron incrementos significativos en sus ingresos. Entre 2015 y 2018, la UPS vio un aumento de $17,008,524.49 en sus ingresos, mientras que la ULVR experimentó un incremento de $4,588,105.28 entre 2014 y 2018. Por su parte, la UCSG registró un incremento del

10% en sus ingresos entre 2014 y 2016, manteniéndolos en los años posteriores. Estos ingresos fueron esenciales para la inversión en infraestructura, tecnología e investigación (Chiroleu, 2013).

Por otra parte, los recortes de fondos en la educación universitaria pública han llevado a un aumento en las tarifas de matrícula en las instituciones privadas, lo que ha impulsado sus ingresos (Andrews, 2019).

Por último, si bien las universidades a menudo enfatizan una misión dual de enseñanza e investigación, los objetivos formales a menudo no se traducen en sistemas de recompensas. La evaluación del desempeño en la academia ha favorecido tradicionalmente los indicadores de investigación, lo que lleva a un sesgo hacia estrategias centradas en la investigación. Las universidades que buscan financiamiento gubernamental, subvenciones de investigación y altos rankings priorizan la contratación y recompensa de académicos con publicaciones sólidas, fortaleciendo aún más el enfoque en la investigación.

Estos desarrollos tienen implicaciones tanto para las estrategias de investigación organizacionales como individuales. "Publicar o perecer" se ha convertido en dominante, mientras que las estrategias que combinan la enseñanza y la investigación quedan marginadas. Tales tendencias pueden sofocar la creatividad y la innovación en la enseñanza.

Un aspecto menos explorado de este debate es la productividad científica individual. La enseñanza implica múltiples productos, incluida la investigación y otras actividades con impacto en la sociedad. Si bien las evaluaciones nacionales de la investigación consideran varias facetas, no existe un estudio que aborde de manera integral los determinantes de la producción total de un investigad

Las publicaciones científicas son ampliamente aceptadas como la esencia de la actividad de investigación. Se han desarrollado dos corrientes de literatura al respecto: una que describe las leyes que subyacen a la distribución de las publicaciones de investigación y otra que investiga los determinantes de la productividad individual. El desafío radica en desarrollar indicadores que aborden simultáneamente la productividad y la calidad de la investigación. Los datos de citas y los factores de impacto se utilizan comúnmente.

Ecuador ha aumentado significativamente su producción científica, ocupando el sexto lugar en América Latina y el Caribe en publicaciones Scopus. Este crecimiento está relacionado con cambios en los roles y las relaciones de las universidades con la sociedad, impulsados por un nuevo marco de políticas públicas tras la incorporación del Estado Social Democrático en la Constitución de 2008. Este marco enfatiza la formación académica y profesional, la investigación científica y tecnológica, la innovación, la difusión del conocimiento y la resolución de problemas alineados con los objetivos de desarrollo.

Objectives and Structure

Objectives and Structure

El objetivo de esta tesis es analizar el efecto de los ingresos en las universidades cofinanciadas en los salarios del personal administrativo y académico, y su numero de publicaciones. Específicamente, los objetivos específicos son analizar si el incremento en los ingresos durante el periodo 2014-2018 vino acompañada de una mejora en la infraestructura y la calidad de la enseñanza tanto en tecnología como en investigación (capitulo 1) determinar la influencia del ingreso de las universidades cofinanciadas en los salarios del personal académico y administrativo (Capitulo 2) y el efecto del salario del personal académico en el número de publicaciones (Capitulo 3).

Capítulo 1

En las últimas décadas, se ha visto un incremento en el número de estudiantes que eligen instituciones de educación privada por la escasez de plazas en universidades públicas. durante el período 2014-2018 en particular, se registró un aumento en las tarifas de matrícula en universidades privadas cofinanciadas en la provincia de Guayas, como la ULVR, USCG y UPS. Esto genera una oportunidad para conocer que efecto ha tenido este incremento de ingresos de las universidades privadas en su calidad educativa.

En el **capítulo 1 se busca conocer si este incremento de ingresos por cobros mejoró la infraestructura y la calidad de la enseñanza tanto en tecnología como en investigación.**

Capítulo 2

En la última década, Ecuador ha experimentado varios cambios en lo que respecta a la educación superior, entre ellos, la modalidad de trabajo y los salarios del personal académico y administrativo. Estos cambios han tenido un impacto significativo en el sistema educativo del país y han generado debate y discusión sobre la calidad y la equidad en la educación superior. En el **segundo capítulo, se busca determinar la influencia de los ingresos de las universidades cofinanciadas en el gasto en salarios del personal académico y administrativo**

Capítulo 3

En los últimos años, Ecuador ha experimentado un dramático aumento en su producción científica, ubicándose actualmente en el sexto lugar en América Latina y el Caribe en términos de la cantidad más alta de publicaciones científicas indexadas en Scopus. Este incremento en la producción científica es un indicativo del crecimiento y el compromiso del país con la investigación y el desarrollo, lo que refuerza su posición en la región en este ámbito. En el último capítulo **se busca determinar la influencia del salario del personal académico en las universidades cofinanciadas en el número de publicaciones científicas.**

Chapter 1. Importance of income in university investment. Province of Guayas - Ecuador

Importancia de los ingresos en la inversión universitaria. Provincia de Guayas – Ecuador

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Importancia de los ingresos en la inversión universitaria. Provincia de Guayas – Ecuador

Arias Barrionuevo Argentina, Jimber del Río Juan

Resumen

En el Ecuador, el número de estudiantes que han ingresado a universidades privadas ha ido en aumento en las últimas décadas debido a la falta de cupos en las universidades públicas ecuatorianas. Debido a esto, Los cobros por pensiones universitarias en universidades cofinanciadas de la provincia del Guayas (ULVR, USCG y UPS) incrementaron durante el período 2014-2018. El objetivo de este estudio es determinar cuál es la relación entre ingresos y gastos en las universidades cofinancias ecuatorianas, en base a la mejora de la infraestructura e inversión en tecnología e investigación. Se realizó un análisis documental en base a los datos anuales sobre las fuentes de ingresos y gastos de las universidades durante el periodo 2014-2021, y mediante la implementación de un modelo econométrico de regresión lineal se encontró la relación existente entre la variable dependiente y las variables independientes. El estudio concluyó que existe relación positiva y no significativa entre los ingresos provenientes de las matrículas, pensiones, rentas, becas y otros con el gasto por inversión de las universidades, al poseer coeficientes de 0.14%, 0.14%, 0.31%, 0.31% y 0.08% respectivamente. La relación entre los ingresos y el gasto en las universidades ecuatorianas refleja la necesidad de una gestión financiera efectiva y estratégica. El incremento de los ingresos brinda oportunidades para invertir en áreas clave, mientras que el gasto responsable y bien planificado garantiza la sostenibilidad y el éxito a largo plazo de las instituciones educativas.

Palabras clave: Matrícula; inversión; gastos en las universidades; instituciones educativas; universidades privadas.

Abstract

In Ecuador, the number of students who have entered private universities has been increasing in recent decades due to the lack of places in Ecuadorian public universities. Due to this, the charges for university pensions in co-financed universities in the province of Guayas (ULVR, USCG and UPS) increased during the period 2014-2018. The objective of this study is to determine the relationship between income and expenses in Ecuadorian co-financed universities, based on the improvement of infrastructure and investment in technology and research. A documentary analysis was carried out based on the annual data on the sources of income and expenses of the universities during the period 2014-2021, and through the implementation of an econometric model of linear regression, the relationship between the dependent variable and the variables was found. independent variables. The study concluded that there is a positive and nonsignificant relationship between the income from tuition, pensions, rents, scholarships and others with the investment expense of the universities, having coefficients of 0.14%, 0.14%, 0.31%, 0.31% and 0.08% respectively. The relationship between income and spending in Ecuadorian universities reflects the need for effective and strategic financial management. Increased revenue provides opportunities to invest in key areas, while responsible and well-planned spending ensures the sustainability and long-term success of educational institutions.

Keywords: Enrollment; investment; university expenditures; educational institutions; private universities.

Introducción

La demanda de la educación superior privada en los últimos años ha registrado un incremento, y, por ende, este incremento se reflejó en un aumento en los ingresos de las universidades. De ahí que es primordial conocer cuál ha sido la respuesta a esta demanda por parte de las universidades cofinanciadas, puesto que la educación superior deja de ser el privilegio de unos pocos y pasa a ser una opción para la sociedad (Ramírez, 2021).

Entre las principales universidades cofinanciadas de la provincia del Guayas están la Universidad Politécnica Salesiana, la Universidad Laica Vicente Rocafuerte, Universidad Católica Santiago de Guayaquil, y la UCSG, las cuales registraron un incremento en sus ingresos del 49%, 28% y 10% respectivamente, los cuales fueron su principal soporte para la inversión en infraestructura, tecnología e investigación (Chiroleu, 2013).

Las debilidades presupuestales de los programas de las universidades públicas provocaron un aumento de la matrícula de las instituciones privadas y, por tanto, de sus ingresos. Sobre esta cuestión, esta investigación denota que cuantos menos ingresos reciban las universidades públicas, más estudiantes ingresarán en las universidades privadas, y este aumento se reflejará en los ingresos por cobros de matrículas, pensiones, y otros

La desviación estándar del cambio relativo en la matrícula fue del 81% para los cursos del plan de estudios general (Yu, Mincieli, & Zipser, 2020). Sin embargo, la presente investigación denota que los incrementos por cobros de matrículas aumentaron en la educación superior. De ahí el sesgo de selección de la muestra en el contexto de un país de bajos ingresos donde la creciente tasa de matriculación en la educación superior parece ir acompañada de una tasa creciente de desajustes entre educación y trabajo (Sam, 2019). Al respecto, se ha acreditado que las matrículas aumentaron, puesto que la titulación obtenida por las universidades da lugar a mayores posibilidades de integración en el mercado laboral y conseguir mejores oportunidades.

La Universidad Católica Santiago de Guayaquil (UCSG), se encuentra conformada actualmente por alrededor de 3500 profesores, con más de, 20000 alumnos (Muñoz, 2015). A su vez, su actual rector es el Ing. Walter Mera Ortiz, Ph.D, y su tipo de financiamiento es privado, la Universidad Politécnica Salesiana (UPS) es una institución privada cofinanciada por el estado, con sedes en las ciudades de Cuenca, Quito y Guayaquil. Está conformada por más de 24.400 estudiantes en las 3 sedes antes mencionadas, y tiene alrededor de 922 profesores (Pérez, 2015). Su rector en funciones es Juan Cárdenas Tapia.

La Universidad Laica Vicente Rocafuerte de Guayaquil (ULVR), es una institución privada de la ciudad de Guayaquil, se encuentra conformada por alrededor de 500 profesores, cuyo rector es Dr. Jorge Torres Prieto y más de 5300 estudiantes se encuentran formándose actualmente en esta institución (García, 2018). En este contexto, invertir los ingresos de las universidades privadas es

crucial para mejorar la infraestructura, desarrollar programas académicos, fomentar la investigación, apoyar a los estudiantes y garantizar la sostenibilidad financiera. Estas inversiones contribuyen al crecimiento y la excelencia de las instituciones, y tienen un impacto directo en la calidad de la educación superior ofrecida. La falta de inversión en universidades privadas puede tener consecuencias negativas en la infraestructura, programas académicos, calidad educativa, investigación y competitividad de la institución. Además, puede limitar las oportunidades de los estudiantes y la capacidad de la universidad para contribuir al avance y desarrollo de la sociedad en general. Por lo tanto, es importante que las universidades privadas generen mecanismos para la inversión de sus ingresos. Por esta razón es necesario determinar cuál es la relación entre ingresos y gastos en las universidades privadas ecuatorianas, considerando las áreas estratégicas para el óptimo desarrollo y ejecución de la planificación educativa.

Solo la asignación óptima de recursos financieros podrá asegurar una educación superior de calidad, y maximizar los beneficios percibidos tanto para las universidades como para la sociedad (Guapi, 2015). Las universidades objeto de estudio son: la Universidad Católica Santiago de Guayaquil (UCSG), la Universidad Politécnica Salesiana (UPS) y la Universidad Laica Vicente de Guayaquil (ULVR), ya que estas son las principales universidades privadas de Guayaquil (Vargas, 2019).

La presente investigación realizó una revisión bibliográfica de trabajos realizados en los últimos años sobre la temática para profundizar en las bases de las variables de estudio con la finalidad de determinar cuál es la relación entre ingresos y gastos en las universidades cofinancias ecuatorianas; posterior a ello, se diseñó un modelo econométrico de regresión lineal, donde se estudiaron las variables: ingresos versus los gastos realizados por las universidades cofinanciadas ya antes mencionadas, cuyos ingresos están representados por: ingresos por matrículas, ingresos por becas, ingresos por servicios académicos prestados, créditos académicos y rentas del estado. Todo esto con el fin de identificar cuál ha sido la incidencia de los ingresos sobre los gastos de las universidades. Se planteó un análisis del control económico con objeto de constatar el comportamiento de los ingresos universitarios por cobros de matrículas, pensiones y otros. Estos cobros tienen una gran importancia en las distribuciones de ingresos y de gastos en las diferentes actividades que realizan las universidades, de acuerdo a cada gestión ejecutada en un período determinado que se aplica desde la creación de estas instituciones.

Concepción de las universidades en la sociedad

El principal objetivo de las instituciones de educación universitaria es formar profesionales íntegros e integrales (García & Villegas, 2019). Una de las relaciones examinadas con más frecuencia en la educación superior es la correlación entre los aumentos de las tasas de matrícula y la demanda de educación superior (Havranek, Irsova, & Zeynalova, 2018). Sobre esta casuística, se puede afirmar que el incremento en el cobro de las matrículas ocasiona un incremento en los ingresos en las instituciones de enseñanza superior.

Calidad del gasto universitario

La calidad del gasto es definida como desembolsos que aseguren la utilización de recursos públicos tanto de manera eficaz como eficiente, con la finalidad de elevar las posibilidades de crecimiento y garantizar de manera constante grados crecientes de equidad distributiva; así mismo, la medición de su calidad está dado por la incorporación de numerosos factores que inciden en la consecución de objetivos macroeconómicos y de política fiscal previamente planteados (Armijo y Espada, 2014).

En cuanto a los principales rubros en los cuales se debería invertir, para Barsky y Corengia (2017), el manejo de nuevas tecnologías es fundamental en las universidades, porque son la única manera de tener un crecimiento sostenido a largo plazo. Por su parte, la Organización de Naciones Unidas para la Educación (UNESCO) (2020) indica que es necesario que las universidades cuenten con recursos tecnológicos propios, y sobre todo asequibles para los estudiantes y personal docente. De ahí que la presente investigación pretende cuantificar cuál ha sido el aporte en tecnología de las universidades cofinanciadas del país, puesto que como se citó en las investigaciones anteriores, esto es fundamental para la educación superior.

Fuentes de financiamiento

Las instituciones de educación superior dependen de diversas fuentes de ingresos para financiar sus operaciones. Las principales fuentes de ingresos de las instituciones de educación superior incluyen la financiación del gobierno, las tasas de matrícula, las donaciones, las ganancias de dotación y las ganancias empresariales (Chatterton, P., & Goddard, 2000; Cunningham & Cochi-Ficano, 2002; Cai & Kivistö, 2013; Han & Xu, 2019; Johnstone, 2009).

El financiamiento es un desafío para toda institución de educación superior, que deben enfrentar la disminución de aportes gubernamentales y la creciente demanda de acceso a la educación superior. Las IES buscan fuentes alternativas de financiamiento a través de la gestión y captación de recursos financieros por medio de distintas vías. La diversificación de las fuentes de financiamiento en las IES se promueve a nivel gubernamental e internacional, incentivando el cobro de matrículas, la venta de servicios y la asociación con entidades socioeconómicas, para poder llevar a cabo sus laborales (Bravo 2020).

El autor Naranjo (2018) propone cuatro sistemas organizativos bajo cuatro criterios: determinación de la oferta, regulación de la demanda, reglas de equidad y reglas de eficiencia. A su vez presentan dos sistemas extremos de financiamiento, los cuales son el de libre competencia, en el cual todo es autofinanciado por medio del pago de pensiones y matriculas, y el del aporte estatal integral, en el cual toda la educación universitaria es subsidiada por el estado y es por ello gratuita, además de dos escenarios intermedios (crédito fiscal y financiamiento tributario). También menciona el uso de vouchers, en el cual el estado subsidia a los estudiantes parte de la educación por medio de un crédito.

La inversión en la educación superior

Las instituciones de educación superior, al igual que otras organizaciones, realizan inversiones en propiedad, planta y equipo (PPE) e intangibles para respaldar sus operaciones y mejorar su capacidad para brindar servicios educativos. En este sentido, las instituciones de educación superior invierten en la adquisición, construcción y mantenimiento de edificios, aulas, laboratorios, bibliotecas, instalaciones deportivas y otros activos físicos necesarios para su funcionamiento. Estas inversiones en PPE son esenciales para proporcionar un entorno adecuado para la enseñanza, el aprendizaje y la investigación (Caballero y Lamattina, 2010).

Del mismo modo, también invierten en equipos y tecnología necesarios para apoyar la enseñanza y la investigación. Esto puede incluir computadoras, equipos de laboratorio, equipos audiovisuales, herramientas especializadas, mobiliario, entre otros. Estos activos permiten a los estudiantes y profesores llevar a cabo actividades académicas y experimentales de manera efectiva (Martínez y Barreto, 2018).

Además de las inversiones iniciales, las instituciones de educación superior deben destinar recursos para el mantenimiento y mejoras periódicas de sus activos físicos. Esto implica la reparación, renovación y actualización de edificios y equipos para garantizar su funcionamiento óptimo y mantenerlos al día con los avances tecnológicos.

Asimismo, las instituciones de educación superior invierten en el desarrollo de programas académicos de calidad, incluyendo la contratación de profesores expertos en diferentes disciplinas, el diseño de planes de estudio actualizados, la creación de material didáctico y la implementación de tecnología educativa. Estos activos intangibles contribuyen a la reputación y calidad de la educación ofrecida (Rama, 2012).

Las inversiones en investigación y desarrollo son fundamentales para las instituciones de educación superior. Esto puede incluir la financiación de proyectos de investigación, la creación de laboratorios especializados, la adquisición de bases de datos y recursos de información, y la promoción de actividades de innovación y transferencia de tecnología.

Es importante destacar que las inversiones en PPE e intangibles en las instituciones de educación superior requieren una planificación cuidadosa y una gestión adecuada. Esto implica evaluar las

necesidades, establecer prioridades, considerar los recursos financieros disponibles y garantizar un mantenimiento y renovación adecuados para maximizar el retorno de la inversión y mantener la calidad de los servicios educativos.

Beneficios de seguir una carrera universitaria

Asistir a una carrera universitaria tiene un efecto sumamente grande en los jóvenes que aplican por una, Gómez (2005) destaca que los graduados universitarios están más inclinados a involucrarse en actividades que puedan agregar algo a su conocimiento y que durante su permanencia en la universidad, las actitudes y valores de los alumnos tienden a ser más abiertos, tolerantes, altruistas, humanitarios y liberales. También menciona que las universidades tienen efectos diferenciales en los estudiantes y que sería interesante estudiar los cambios que produce cada una de ellas.

Por otro lado, Geva (2016) argumenta que la universidad no puede contrarrestar la influencia familiar en la formación de actitudes y valores de exalumnos en el 60% de los casos. Esto debido a que en muchos casos las personas vienen ya con ideas preconcebidas, por lo que es difícil para que las universidades puedan cambiar estas actitudes de los estudiantes.

La asignación de recursos de ingresos en las instituciones de educación superior

La asignación de recursos de ingresos en las instituciones de educación superior es un tema complejo que requiere una mejora continua en áreas como infraestructura, investigación y tecnología (Kim & Garman, 2004). El estrés financiero puede afectar negativamente el rendimiento en el lugar de trabajo, y se ha descubierto que los programas de educación financiera en el lugar de trabajo aumentan la confianza de los empleados en sus decisiones de inversión, cambian sus actitudes en direcciones positivas y mejoran sus comportamientos de gestión financiera personal (Kim & Garman, 2004). La incapacidad del estado para soportar toda la creciente carga financiera de la educación superior ha llevado a explorar el papel de la autofinanciación y de los sectores privados sin fines de lucro y con fines de lucro, al compartir la matrícula y la carga de los costos (Sanyal & Johnstone, 2011). El financiamiento por desempeño se ha implementado en instituciones de educación superior para mejorar la asignación de recursos y la planificación estratégica (McKeown, 2013). Se ha encontrado que la asignación presupuestaria afecta la calidad de la educación superior, y los académicos han tratado de determinar la asociación entre la calidad de la educación superior y las asignaciones financieras (Amin & Sheikh, 2021). El coste por alumno en la etapa de educación superior es inferior al de los países de la OCDE, e incluso inferior al del nivel elemental, a pesar del aumento del presupuesto de educación superior en la última década (Lee & Lee, 2022). La inversión en educación es la principal forma de inversión en capital humano, especialmente en educación superior, y el método del valor presente neto en la gestión financiera se ha utilizado para analizar la inversión individual en educación superior (Haixia, 2015). La práctica de Waqf se ha estudiado en Pakistán con respecto a su utilización en la financiación de instituciones de educación superior (Usman & Ab Rahman, 2020). La

financiación de la educación superior con cargo al presupuesto público en los países menos desarrollados no es equitativa, ya que conduce a una redistribución de los ingresos de los grupos de ingresos más bajos a los más altos (Khan, 1991). Las instituciones de educación superior se han enfrentado a estrictas limitaciones financieras y se ha convertido en una necesidad para ellas desarrollar modelos de planificación para la asignación eficiente de recursos para su propia supervivencia (Hemaida & Hupfer, 2011). Se ha evaluado el estado actual de la inversión pública en educación superior en varias regiones de China y se han identificado los elementos que influyen en la eficacia de la inversión pública en educación superior (Yu, 2023). Se ha propuesto un modelo conceptual del sistema de información de gestión educativa para instituciones de educación superior para mejorar la asignación de recursos y la planificación estratégica (Khamdamov, Abdullayev, Elov & Sultanov, 2020).

Metodología

El presente estudio utilizará datos anuales sobre las fuentes de ingresos y egresos de las universidades ULVR, USCG y UPS durante el periodo comprendido entre los años 2014 y 2021, mediante la implementación de un modelo econométrico de regresión lineal, el cual permitirá explicar la relación existente entre la variable dependiente y las variables independientes.

Modelo de regresión lineal

Un modelo de regresión lineal es una técnica econometría que permite la predicción de un valor por medio del uso de otros valores que se encuentran relacionados y son conocidos. Este modela matemáticamente nuestra variable dependiente por medio de un grupo de variables independientes, también llamadas de control.

Modelo Postulado

Se desea analizar el impacto de los ingresos de pensiones, matrículas, y otros rubros frente a la inversión y gastos de las universidades ULVR, UPS y UCSG. Para ello se empleó el siguiente modelo de datos de panel con efectos fijos:

$$\text{Modelo: } LGASTOS = \beta_0 + \beta_{MATRICULAS} LMATRICULAS + \beta_{PENSIONES} LPENSIONES +$$

$$\beta_{BECAS} LBECAS + \beta_{RENTAS} LRENTAS + \beta_{OTROS} LOTROS + \varepsilon$$

Donde:

LGASTOS= Gastos en personal docente, servicios, administración, y bienes y servicios de consumo.

LMATRICULAS= Ingresos por matrículas.

LPENSIONES= Ingresos por pensiones, aranceles, o créditos académicos.

LBECAS= Ingresos por becas.

LRENTAS= Ingresos por rentas del estado.

LOTROS= Ingresos por otros servicios académicos prestados.

La implementación de este modelo permitirá identificar la relación económica existente entre las fuentes de ingresos y el gasto de las universidades. Se espera que todos los coeficientes sean mayores a cero. Cabe mencionar que este modelo es utilizado para determinar los efectos de los coeficientes por cada universidad mencionada anteriormente.

Fuente de datos

Para el desarrollo del estudio se obtuvieron los datos de los gastos e ingresos en las siguientes instituciones universitarias de la ciudad de Guayaquil, Ecuador: ULVR, USCG y UPS, donde se agrupa el total de gastos por personal (docentes, servicios y administración), y bienes y servicios de consumo. Además, los ingresos se detallan por ingresos por matrículas, pensiones arancelarias o créditos académicos, becas, rentas del estado, y otros servicios académicos prestados.

Estos datos se obtuvieron de acuerdo con el registro de ingresos e inversión de las universidades ULVR, USCG y UPS en el periodo 2014-2018. Estos datos son organizados en base a las variables de interés, a través del modelo de regresión lineal múltiple para datos de panel con efectos fijos, el cual permitirá identificar la incidencia de las fuentes de ingresos sobre los gastos de las universidades.

Evolución de gastos universidades cofinanciadas

En el siguiente apartado se presenta la evolución de los gastos por universidades. En el caso de la Universidad Politécnica Salesiana, sus gastos han presentado una tendencia creciente, habiendo registrado 55.97 millones de dólares en el 2014; para el 2015 la cifra aumentó en 64.67 millones de dólares a una tasa de crecimiento del 16%; para el siguiente año la cifra aumentó en 70.56 millones de dólares a una tasa del 9%; en el 2017 la tendencia se mantuvo y los gastos presentaron un aumento de 73.39 millones de dólares a una razón del 4%; para el 2018 los gastos disminuyeron en 71.87 millones de dólares a una tasa de decrecimiento del -2%, en el 2019 la tendencia se mantuvo y los gastos se redujeron en 16%, para el 2020, 4.7 millones de dólares adicionales de los gastos llegando a un total de 65.23 millones de dólares y para el 2021 hubo un ligero aumento de los gastos en 0,45% respecto

al año anterior. En general los gastos promedio para la UPS fueron de 65.96 millones de dólares y los mismos crecieron a una razón del 3%, (ver Tabla 1).

Tabla 1: Evolución de los gastos de las Universidad Politécnica Salesiana (UPS)

Año	Gastos UPS	Variación %
2014	55.971.274	
2015	64.672.061	16%
2016	70.556.356	9%
2017	73.391.348	4%
2018	71.869.003	-2%
2019	60.534.318	-16%
2020	65.235.148	8%
2021	65.527.283	0,45%
Promedio	**65.969.599**	**3%**

Nota. Estado de resultados integrales y presupuestos ejecutados de las universidades de estudios (los gastos estan en dólares americanos).

Con respecto a la Universidad Católica Santiago de Guayaquil (UCSG), sus gastos han presentado una tendencia creciente, habiendo registrado 72.52 millones de dólares en el 2014; para el 2015 la cifra aumentó en 78.62 millones de dólares a una tasa de crecimiento del 8%; para el siguiente año la cifra disminuyó en 77.85 millones de dólares a una tasa del -1%; en el 2017 la tendencia cambió y los gastos presentaron un ligero aumento de 78.11 millones de dólares a una razón del 4%; para el 2018 los gastos se expandieron en 84.02 millones de dólares a una tasa de crecimiento del 8% en el 2019 la tendencia cambió y los gastos se redujeron en 46%, para el 2020, 3.87 millones de dólares menos en los gastos llegando a un total de 41,73 millones de dólares y para el 2021 hubo un aumento de los gastos en 52% respecto al año anterior. En general los gastos promedio para la UCSG fueron de 67.75 millones de dólares y los mismos crecieron a una razón del 2%, (ver Tabla 2).

Tabla 2: Evolución de los gastos de la Universidad Católica Santiago de Guayaquil

Año	Gastos UCSG	Variación %
2014	72.515.287	
2015	78.618.403	8%
2016	77.854.839	-1%
2017	78.109.550	0.3%
2018	84.016.968	8%
2019	45.591.017	-46%
2020	41.725.111	-8%
2021	63.571.079	52%
Promedio	**67.750.282**	**2%**

Nota. Estado de resultados integrales y presupuestos ejecutados de las universidades de estudios (los gastos estan en dólares americanos).

Por último, los gastos de la Universidad Laica Vicente Rocafuerte (ULVR) han presentado un tendencia creciente, habiendo registrado 18.42 millones de dólares en el 2014; para el 2015 la cifra aumentó en 19.48 millones de dólares a una tasa de crecimiento del 6%; para el siguiente año la cifra se contrajo en 16.81 millones de dólares a una tasa del -14%; en el 2017 la tendencia cambió y los gastos presentaron una expansión de 18.36 millones de dólares a una razón del 9%; para el 2018, los gastos se incrementaron en 19.01 millones de dólares a una tasa de crecimiento del 4 en el 2019 la tendencia cambió y los gastos se redujeron en 42%, para el 2020, 7.55 millones de dólares menos en los gastos llegando a un total de 10,07 millones de dólares y para el 2021 hubo una disminución de los gastos en 3% respecto al año anterior. En general los gastos promedio para la UCSG fueron de 16.13 millones de dólares y los mismos crecieron a una razón del 7% (ver Tabla 3).

Tabla 3: Evolución de los gastos de la Universidad Laica Vicente Rocafuerte

Año	Gastos ULVR	Variación %
2014	18.408.380	
2015	19.479.335	6%
2016	16.812.197	-14%
2017	18.362.687	9%
2018	19.013.542	4%
2019	17.954.851	-6%
2020	10.401.644	-42%
2021	10.072.412	-3%
Promedio	**16.313.131**	**-7%**

Nota. Estado de resultados integrales y presupuestos ejecutados de las universidades de estudios (los gastos estan en dólares americanos).

Modelo econométrico

A continuación, en la Tabla 4 se analizan los resultados del modelo econométrico, donde se puede destacar que una de las universidades que presenta un mayor crecimiento económico a partir de los ingresos de pensiones, matrículas y otros, y gastos por infraestructura, tecnologías y estudios es la UCSG. Es decir, que por cada 1% que incrementan los ingresos de pensiones, matrículas y otros en la UCSG, la misma invierte 8.12% en gastos por infraestructura, tecnologías y estudios, de la misma manera la ULVR por cada 1 % que incrementan los ingresos, esta universidad invierte un 7.64% en gastos, mientras que la UPS por cada 1% que incrementan los ingresos de pensiones, matrículas y otros, esta invierte un 7.94% en gastos por infraestructura, tecnología y estudios.

Tabla 4: Modelo econométrico

Universidad	Coeficiente	Error estándar	Valor t
UCSG	8.12	5.49	1.48
ULVR	7.64	5.08	1.51
UPS	7.94	5.56	1.43

Nota. Elaboración propia (Signif. Codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1)

Una vez discutidos los resultados del modelo econométrico, este es validado por medio de las pruebas de diagnóstico para identificar si los modelos cumplen con los supuestos de regresión. Los resultados del modelo no presentan problemas, es decir, cumplen los supuestos de regresión. Por lo tanto, el modelo se ajusta de manera correcta a los datos (Tabla 5).

Tabla 5: Pruebas de diagnostico

Pruebas de Diagnóstico	P-Values
Breusch-Godfrey (Autocorrelación) [1]	0.5219
Durbin-Watson (Autocorrelación) [2]	0.07891
Breusch-Pagan (Heterocedasticidad) [3]	0.4452
NCV Test (Heterocedasticidad) [4]	0.66892
Jarque-Bera (Normality of errors) [5]	0.387
Anderson-Darling (Normality of errors) [6]	0.092
Shapiro-Wilk (Normality of errors) [7]	0.084

Nota. Test obtenidos de 1: Godfrey (1978), 2: Durbin y Watson, 3: Breusch y Pagan (1979), 4: Weisberg (2014), 5: Jarque y Bera (1980), 6: D'Agostino (2017) y 7: Royston (1982).

Por otro lado, en la Tabla 6 se puede observar el modelo econométrico de los datos de panel, el cual fue utilizado para estimar la relación e incidencia de los ingresos de pensiones, matrículas y otros, sobre los gastos por infraestructura, estudios y tecnología en las Universidades Cofinanciadas de la Provincia del Guayas. Se puede evidenciar que para la regresión lineal múltiple (MCO) y modelo agrupado la constante tienen una incidencia significativa sobre los gastos por infraestructura, tecnología y estudios. Por otro lado, en la regresión de efectos fijos, las becas son significativos sobre los gastos.

Tabla 6: Ingresos por pensiones

Gastos	Regresión lineal múltiple	Regresión del modelo agrupado	Regresión de efectos fijos
Constante	3.82554**	3.82554**	-
Matriculas	0.14496	0.14496	0.123986
Pensiones	0.14984	0.14984	-0.141787
Rentas	0.31493	0.31493	0.140212
Becas	0.30564	0.30564	0.508878**
Otros	0.08816	0.08816	-0.025855

Nota. *,**,*** son los niveles de significancia del 10%, 5% y 1% respectivamente

Se empleó la prueba de diagnóstico de Fisher (prueba F) individual o de efectos en el tiempo, con el objetivo de comprobar cuál es el modelo de regresión que mejor se ajusta a los datos en estudio (ver Tabla 7).

Tabla 7: Prueba de diagnóstico Fisher

Test	Valor p
F-test for Individual and/or Time Effects	0.1084*

Nota. *,**,*** son los niveles de significancia del 10%, 5% y 1% respectivamente

Se puede observar que la prueba F indica que se debe utilizar el modelo agrupado. Basado en estos resultados, se evidencia que por el incremento en 1% de los ingresos de matrículas en las Universidades Cofinanciadas de la Provincia del Guayas, el valor de los gastos por infraestructura, estudios y tecnología crecerá en un 0.14%, dicho coeficiente no es estadísticamente significativo.

Por otro lado, cuando los ingresos de pensiones incrementan en 1% en dichas universidades los gastos incrementan 0.15%, dicho coeficiente no es estadísticamente significativo. En cuanto los ingresos por rentas del estado, cuando estas incrementan en 1% los gastos por infraestructura, estudios y tecnología aumentarán en un 0.14%.

De igual forma, cuando los ingresos por becas aumentan en 1% estos gastos por infraestructura, estudios y tecnología incrementarán en 0.31%, y finalmente, cuando otros ingresos incrementan en 1% el valor de dichos gastos crecerá en un 0.08%, cabe mencionar que dichos coeficientes no son estadísticamente significativos.

Esta relación entre el aumento de los ingresos y el aumento de los gastos en las universidades, implica que a medida que los ingresos de las universidades aumentan, también aumentan sus gastos en general. En el caso de estas organizaciones, el aumento de la matrícula de estudiantes, ha provocado que los ingresos generados por las tarifas de matrícula y otros conceptos relacionados aumenten, tal como plantean diversos autores consultados (Chatterton & Goddard, 2000; Cunningham & Cochi-Ficano, 2002; Cai & Kivistö, 2013; Han & Xu, 2019; Johnstone, 2009). Autores como Amin & Sheikh, (2021) señalan que respuesta a este crecimiento, las universidades pueden destinar una parte de esos ingresos adicionales a aumentar sus gastos para acomodar y brindar servicios adecuados a la creciente población estudiantil.

Aunque exista una relación entre el aumento de los ingresos y el aumento de los gastos, la forma en que las universidades gestionan sus finanzas y toman decisiones sobre la asignación de recursos puede variar. Cada universidad puede tener prioridades y enfoques diferentes en términos de cómo utilizan sus ingresos adicionales para impulsar su crecimiento y mejorar la calidad educativa.

Con el incremento de la matrícula, las universidades se enfrentan a nuevas necesidades para acomodar a los estudiantes adicionales. Caballero y Lamattina, (2010) mencionan como esto implica

aumentar los gastos en diferentes áreas para satisfacer las demandas de una población estudiantil en crecimiento. Para atender a más estudiantes, es posible que se necesite contratar a profesores adicionales, personal administrativo y de apoyo para mantener una adecuada relación estudiante-facultad y brindar servicios de calidad (Heckman, 1979). Con un mayor número de estudiantes, se puede requerir la construcción o ampliación de edificios, salones de clases, laboratorios, bibliotecas, instalaciones deportivas, entre otros. Estos proyectos implican gastos en construcción, equipamiento y mantenimiento, de acuerdo a los aportes de Kim & Garman (2004).

Las universidades pueden invertir en tecnología educativa, como sistemas de aprendizaje en línea, plataformas de gestión del aprendizaje y recursos digitales, para adaptarse a las necesidades de una matrícula en crecimiento, según lo sugieren Barsky y Corengia (2017). De igual modo, a medida que aumenta el número de estudiantes, es importante brindar servicios de apoyo, asesoría académica, servicios de salud, servicios de bienestar estudiantil y otras actividades extracurriculares. Estos servicios adicionales conllevan un aumento en los gastos.

Las universidades suelen esforzarse por mantener altos estándares de calidad educativa y competitividad. Con un aumento en la matrícula, se hace necesario asignar recursos financieros para mantener la calidad de los programas académicos, actualizar los materiales de estudio, ofrecer oportunidades de investigación y desarrollo, y mantener la infraestructura adecuada. De este modo, en general estos ingresos adicionales se utilizan para afrontar las necesidades asociadas al crecimiento de la población estudiantil, lo que implica un aumento de los gastos en áreas como contratación de personal, infraestructura, recursos tecnológicos y servicios estudiantiles. La finalidad es garantizar una experiencia educativa de calidad y adaptada al crecimiento de la universidad.

Conclusiones

A partir de los resultados obtenidos en este trabajo, podemos concluir que existe una relación positiva entre los ingresos por cobro de pensiones, matrículas y otros rubros, y los gastos por infraestructura, tecnologías y estudios en las universidades UPS, UCSG y ULVR. Esto sugiere que, a nivel de universidades, los ingresos por cobro benefician a la mejora de las instituciones, ya que al aumentar estos, aumenta la inversión en estas entidades. Sin embargo, cabe recalcar que las variables no resultaron estadísticamente significativas, probablemente debido a la falta de una muestra más grande.

Además, se encontró que la relación entre los ingresos por renta, becas y otros rubros y la inversión también fue positiva, pero no significativa. De manera similar, se encontró una relación positiva entre los ingresos por matrículas y pensiones y el gasto por inversión de las universidades, pero esta no fue estadísticamente significativa. Por lo tanto, se requiere una mayor investigación en el futuro para comprender mejor estas relaciones.

En resumen, los resultados obtenidos en este estudio explican cómo los ingresos por matrículas, aranceles, pensiones o créditos académicos y otros, hacen posible invertir en infraestructura, investigación y tecnología, generando a su vez un aumento en el número de estudiantes en las diferentes carreras de estas instituciones universitarias. Es necesario considerar estas relaciones en los sistemas regulatorios y de financiamiento de las universidades para seguir mejorando la calidad de la educación superior y promover la equidad en el acceso a ella.

El análisis de la relación entre los ingresos y el gasto en las universidades ecuatorianas revela un vínculo estrecho y significativo entre ambos factores. Se ha demostrado que un incremento en los ingresos generados por las universidades conlleva un aumento proporcional en los gastos realizados por estas instituciones. El aumento de los ingresos en las universidades ecuatorianas puede estar impulsado por varios factores, como el crecimiento de la matrícula estudiantil, el incremento de las tarifas de matrícula, el aumento en la financiación gubernamental u otras fuentes de ingresos adicionales. A medida que los ingresos se expanden, las universidades se enfrentan a la necesidad de destinar recursos financieros para abordar diversas áreas.

El incremento en los gastos de las universidades ecuatorianas puede estar asociado a diferentes aspectos. Esto puede incluir la contratación de personal académico y administrativo adicional, el mejoramiento de las instalaciones y la infraestructura, la adquisición de equipos y tecnología educativa, la promoción de actividades de investigación y desarrollo, así como el fortalecimiento de los servicios estudiantiles. La relación entre los ingresos y el gasto es crucial para garantizar el adecuado funcionamiento de las universidades y su capacidad para brindar una educación de calidad.

Sin embargo, es importante que las instituciones ejerzan una gestión financiera sólida y estratégica para asegurar un equilibrio adecuado entre los ingresos generados y los gastos realizados. Además, es necesario que las universidades realicen una evaluación constante de su estructura financiera y adopten prácticas de transparencia y rendición de cuentas. Esto permitirá una asignación eficiente de los recursos financieros, una planificación adecuada y la toma de decisiones informadas para maximizar los beneficios en términos de calidad educativa, investigación, desarrollo institucional y servicios estudiantiles

Chapter 2. Influence of the revenues of the co-financed universities of Ecuador on the expenditure for salaries of the academic and administrative personnel

Chapter 2. Influence of the revenues of the co-financed universities of Ecuador on the expenditure for salaries of the academic and administrative personnel

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Abstract – In the last decade, Ecuador has undergone several changes with regard to higher education, among them, the modality of work and the salaries of the academic and administrative personnel. The main objective of this research is to determine the influence of the income of the co-financed universities on the expenditure for salaries of the academic and administrative personnel. Two econometric models were used for this end: the multiple linear regression model, which by means of ordinary least squares was able to measure the individual effects of the independent variable on the dependent variable. Then, the panel data model was applied to measure the pooled effects of the study variable. The results of the first model suggest that the Universidad Politécnica Salesiana and the Universidad Católica de Santiago de Guayaquil benefit from the increase in staff salaries, which led to the growth of their income. At the same time, the results of the analysis using the panel data with random effects show that an increase of 1% in the variable academic salaries leads to an average increase in income of 0.49%. Conversely, the 1% increase in expenses in administrative salaries leads to a reduction of -0.08% in the income of the universities. What is unique about this research is how the increase in salaries influences the income of the universities.

Keywords – University, income, academic personnel, econometric models, salaries.

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Introduction

Following the entry into force of the 2008 constitution, it was determined that public education, from the lowest to the highest levels, would be free for Ecuadorian citizens. This shifted the administrative and financing structures of Ecuadorian public universities, which are tuition-based and relatively autonomous, to total dependence on the central government for budget allocations, student admission, and administration [20].

A second important event that affected higher education was the approval of the Higher Education Act in August 2010. This law sought to further increase the regulation of local universities by increasing their accountability to the central government and leading their efforts to promote research and education in accordance with the economic and social development needs of the country. Three national institutions were created to supervise the higher education institutions in the country, approve new degree programs, regulate the admission of students, distribute state assignments to public universities, stimulate research activity, and accredit existing academic programs and universities [2].

Academic policies and their role in universities have been revolutionized in the search for a quality higher education in Ecuador. The Organic Law of Higher Education (LOES) not only ordered the creation of an accreditation entity to ensure institutional compliance but also authorized the creation of a regulation that oversees the details of personal academic activities and the hierarchy of post-secondary institutions in the country.

The objective of the regulatory manual, Career Regulation and Ranking of the Professor and Researcher of the Higher Education System [5], is to establish binding norms that regulate the career and rank of academic staff in tertiary educational institutions, selection processes, admission processes, job, stability, salary scale, professional development, evaluation, promotion, incentives, suspension, and retirement.

Due to these efforts to improve the quality of Ecuadorian higher education, the qualifications and activities of professors have come under intense scrutiny. Historically, professors focused primarily on teaching, and very few professors were full-time employees, held degrees beyond a bachelor's or master's degree, mentored students, or did so Another stipulation is the categorization of universities into a typology: a research university or a teaching-research university. This typology classifies universities into two categories based primarily on how many faculty members have PhDs. In research universities, 70% of the faculty must hold a doctorate, while in teaching-research universities, 40% of the faculty are required to hold a doctorate [6].

This legislative demand for professors with doctorates and the lack of doctoral programs in Ecuador has led many professors to leave the country to pursue a doctorate and has led to the importation of doctors from other countries, most at a governmental expense. According to data from 2015, 2,278 out

of 35,501 professors in Ecuadorian universities have doctorates [10]. This number has risen substantially since there were approximately 500 PhDs in the higher education sector in 2008 [13].

After the approval of the 2008 constitution and the LOES in 2010, and the subsequent accreditation expectations and the regulations governing the activities of the academic staff, all universities took it upon themselves to ensure that full-time professors hold fourth-level degrees (doctorate or equivalent) and carry out research and do publications. The LOES deadline (October 12, 2017) for professors to obtain a doctorate has been a point of intense debate since many believe it is impractical [4]. While these are challenges for the sector, the new laws and policies notably change the roles of professors in higher education institutions in Ecuador. Now, many faculty members are required to possess credentials in the form of a degree, and the research and publication component has become a critical expectation of access to university work.

During the 2007-2017 period, the higher education policy seeks to improve educational opportunities for neglected population groups, greater accountability for local universities, and a more active role for Ecuadorian universities in the economic and social development of the country and its citizens. University administrators and professors are concerned about the loss of autonomy in universities, the fact that the administrative and fiscal infrastructures currently in force cannot cope with the new demands and the negative effect that these changes have had on the rights of the faculty members [21].

Most professors in Ecuador do not work full-time, and universities have attracted many faculty members with practical experience to meet their instructional needs as part-time professors. It is estimated that less than half of university academic staff work full time. Adjunct professors teach different courses and are not expected to fully engage in university life [2].

Full-time professors in the Ecuadorian system have a heavy teaching load compared to international standards: they are expected to teach an average of 40 hours a week and fulfill additional administrative and service responsibilities. There is no system for permanence or tenure tracking as it is common in the United States, where tenure is closely related to the research mission of the university [21].

For permanent appointments, recruitment is carried out through a system of "public competitions," in which a committee first evaluates the curriculum of the applicants, followed by written and oral tests that verify the knowledge of the subject and their academic and teaching skills. For temporary appointments, the system is much more lenient and varies entirely according to the internal policies of the institutions. The effectiveness of the academic staff is measured differently in universities. However, most institutions employ a combination of self-evaluation, student feedback, and the evaluation of the career director [17]

Before the recent changes, full-time professors at public universities were expected to work 20 hours a week. This allowed many professors to find additional employment, as university salaries were

low. However, under the 2010 Higher Education Act, universities needed to find the resources to pay for supplementary 10 hours a week; they had to ensure that faculty members devoted time to research and service, and they had to monitor their presence in the faculty during working hours. Professors are expected to record their check-in and check-out times using fingerprint identification.

Since universities in Ecuador have focused mainly on education at the undergraduate level, education at the graduate level is scattered and immature, and there is not sufficient supply for the training of doctors in the country. Currently, only two universities in the country offer doctoral studies in social sciences, but so far, no doctoral studies have been completed in Ecuador [11].

As mentioned above, the majority of professors in the Ecuadorian higher education system did not hold graduate degrees, and doctoral degrees were rare. This could be expected in an environment where historical and philosophical emphasis has been given to the teaching missions of universities. The government of Ecuador hopes to address this deficiency by stipulating that after 2010 all those who aspire to enter the university system as professors shall hold a masters' degree. Before 2010, the only formal requirement to teach at a university was a bachelor's degree. The law also established a seven-year deadline (starting in 2010) for all professors employed in the university system to obtain doctoral degrees. The intention behind this requirement is clear: better-trained professors will be able to provide a higher-level education, will be able to conduct research independently, and thus, will raise the level of the university system as a whole and contribute to the economic and social development of the country.

The government has become aware of the financial difficulties of these new requirements and has created a scholarship program for university professors and the general public to pursue graduate studies abroad. For 2013, the goal is to provide 3,000 scholarships that cover education, living expenses, and travel expenses to other countries.

As there are few opportunities to pursue Ph.D. studies in Ecuador, interested parties will have to study abroad with considerable personal and professional difficulties. The government has published a list of 1,000 international universities that were approved for postgraduate studies to prevent professors from studying at institutions of dubious academic quality. The measure also mandated that professors could only obtain a graduate degree related to their area of teaching interest, making it very difficult for some to find suitable graduate studies to pursue.

An econometric method model is proposed, where it is shown that if income increases, the expenditure for salaries also increases, and if income falls, expenses decrease. The seven co-financed universities in Ecuador are: Universidad Salesiana Politécnica de Guayaquil, Universidad Católica de Guayaquil, Universidad Católica de Cuenca, Universidad Laica Vicente Rocafuerte de Guayaquil, Universidad del Azuay, Universidad Particular de Loja, and Universidad Técnica Equinoccial.

All co-financed universities exercise strict control on the salaries destined for payments to professors since it is a motivation that compensates for all the dedication, effort, and love towards higher education. In reviewing the annual executed budgets from 2014 to 2020, it was possible to verify that these salaries are higher than the administrative salaries.

The salaries of professors have been improving over time. It is worth mentioning that the professors have also worked hard to achieve their goals and thus obtain a better remuneration, in order to continue educating themselves and achieve their unlimited purposes [26]. The main objective of the co-financed universities is to provide quality teaching services. professors must be up-to-date and comply with the parameters established by each higher education institution to impart knowledge in the different professions offered.

Recent and far-reaching events in the political scene of Ecuador have had a dramatic impact on higher education. These changes have not only impacted the way higher education and public and private universities are funded and governed, but they have also significantly affected the lives and careers of university administrators, professors, and students, and have begun to change the role of the university in Ecuadorian society.

The objective of this research is to determine the influence of the revenues of the co-financed universities on the expenditure for salaries of the academic and administrative staff. The vacuum investigated in this document is how the salary increase influences their income because there is a gap in the literature related to the impact of salaries of the academic and administrative personnel in relation to the income of the universities.

The article is structured as follows: the first section contains the theoretical framework where the regulatory policies of the university academic staff are detailed. In the second section, the study methodology goes into detail. Two models were used: multiple linear regression and the panel data model. Subsequently, the results are established from the models used in the methodology, which are discussed and, finally, the study is concluded.

Literature Review

The investigation and publication of the academic personnel also became of great importance under the policies of national reform, which presented challenges. Van Hoof [22] stated that the research infrastructure is outdated or absent in Ecuador; there have never been many incentives for professors to do research; there is a lack of appreciation regarding the value and importance of research; professors lack understanding of basic methodological research, and there is a chronic lack of funding.

However, according to the legislative codes, one of the primary purposes of the higher education system is the generation of educational, scientific, and technological knowledge. According to Saavedra [18], the government discourse is that research through higher education will be “a

significant contributor to technological advances and innovation, economic growth, development, and global competitiveness" [18].

As Ecuador positions itself as a producer of knowledge, the higher education environment has become a competition for resources. Free tuition at public universities, government centralization of the budget of public universities and spending control, and the threat of suspension of activities by the state-backed quality assurance unit make many universities look for ways to meet the demands of reform policies.

The resource dependency theory provides a way to structure the discussion about higher education reform in Ecuador and the actions administrators take in response to the organizational change in higher education [10]. Correspondingly, it helps to explain that national policies and market dynamics are among the forces that shape access to resources, and the ability of an organization to conduct operations and develop organizational autonomy [14]. Furthermore, it emphasizes power relations and the tactics organizations use to respond to external pressure [16].

Due to the greater fiscal dependence that the public universities of Ecuador currently maintain and the limited human resources available, that is, professors who comply with the standards of the law and accreditation, both for public and private universities, the theory for resource dependency frames the dialogue on how universities should respond to their current environment and how they should interact with each other. The resource dependency theory assumes that a conditio sine qua non to understand the structure or the behavior of an organization, is to first understand the context of its operation [19].

According to the LOES, the financing of these institutions is set by the Law of the Permanent Fund for University and Polytechnic Development (FOPEDEUPO) and comes from the General State Budget, the allocations intended for the public institutions of the higher education system for gratuity, and the revenues generated by enrollment fees, tuition fees, and other fees. Additionally, financing comes from the resources obtained by contributions from international cooperation, benefits obtained from participation in productive activities of goods and services, as long as that participation is not for profit-seeking and is intended for the benefit of the institution.

95% of the economic support of public universities comes from public funds (5% is self-managed), while private universities include co-financed universities and self-financed universities. 60% of the budget of co-financed universities comes from the government, and the self-financed universities depend solely on their own resources, as mentioned above [12].

The allocation of resources will depend on the category obtained by each public university after the evaluation carried out in 2013 when the A, B, C, and D categories were assigned, being A and B, the qualifications recognized for having the best quality, and the ones that receive a higher percentage of

the budget. The financing comes from the taxes collected by the government, which allocates 1.8% of GDP for this purpose [12].

However, what is lacking in the literature are the perspectives of university administrators who work to ensure that their institutions comply with regulations and policies regarding the qualifications and expectations of professors. Likewise, there is a gap in the literature on how the expenditure for the salaries of academic and administrative staff has influenced university revenues once the transition process has been completed with respect to the regulations for improving the capacities of university professors. Therefore, the following hypotheses are raised:

H1: The expenditure for salaries of the academic personnel has a positive influence on the revenues of the universities.

H2: The expenditure for salaries of the administrative personnel has a positive influence on the revenues of the universities.

Methodology

Data source and variables

This section details how the data for the revenues and the expenditure for salaries of the academic and administrative staff was obtained in a sample of six co-financed universities of Ecuador, which are: Universidad Laica Vicente Rocafuerte, Universidad Politécnica Salesiana, Universidad Católica Santiago de Guayaquil, Universidad del Azuay, Universidad Tecnológica Equinoccial, and Universidad Técnica Particular de Loja, during the study period 2017-2020.

Regarding the dependent variable, this corresponds to the total income received by the co-financed universities, that is, the sum of the following entries: enrollment fees, tuition fees, student loans, scholarships, interest rates, state subsidies, among others.

In relation to the independent variables, these include the expenditure for the salary of professors, that is, the remuneration of that personnel in charge of the teaching, supervising, and evaluating practical learning activities or a foreign language, as well as supporting activities in scientific, technological, humanities or arts research. It also includes the expenditure for the salary of the administrative staff, that is, the remuneration of that personnel who carry out technical, economic, and management activities, as well as support, advice, and assist in the development of the university functions.

Econometric model

Multiple linear regression attempts to model the relationship between two or more explanatory variables and a response variable by fitting a linear equation to the observed data. Each value of the independent variable x is associated with a value of the dependent variable y. The population regression line for p explanatory variables x1, x2, ..., xp is defined as $y = \beta 0 + \beta 1\ x1 + \beta 2\ x2 + \cdots + \beta kxk$. This

line describes how the mean response changes and with the explanatory variables. The observed values for y vary around their y means and are assumed to have the same standard deviation. The adjusted values β0, β1, ..., βk estimate the parameters 0, 1, ..., k of the population regression line [8].

Formally, the multiple linear regression model, given n observations, is:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik} + u_i \quad \text{for i = 1, 2, …, n}$$

In the Ordinary Least Squares (OLS) model, the line of best adjust for the observed data is calculated by minimizing the sum of the squares of the vertical deviations from each data point to the line (if a point lies exactly on the line adjusted, then its vertical deviation is 0). Because the deviations are squared first and then added, there are no cancellations between positive and negative values [25].

Based on what was established for the multiple linear regression model, two models were proposed to know the individual effects between the salaries of the academic and administrative personnel and the revenues of the universities. In this sense, the following equations are proposed:

Model 1: $LREVENUES = \beta_0 + \beta_1 LACADEMICPERSONNEL + \varepsilon$

Model 2: $LREVENUES = \beta_0 + \beta_1 LADMINISTRATIVEPERSONNEL + \varepsilon$

Panel data models describe individual behavior both over time and between individuals. There are three types of models: the pooled model, the fixed-effects model, and the random-effects model [3].

Specific individual effects model

This study assumes that there is unobserved heterogeneity among the individuals captured by α_it. The main question is whether the specific effects of each individual α_i are correlated with the regressors.

If they are correlated, the fixed effects model is obtained. If they are not correlated, the random-effects model is obtained [24].

Grouped model

The pooled model specifies constant coefficients, the usual assumptions for cross-sectional analysis [9].

$$y_{it} = \alpha + x_{it}\beta' + \mu_{it}$$

Fixed-effects model

The fixed-effects model makes it possible to correlate the specific effects α_i of each individual with the regressors x. Each individual has a different intercept term and the same slope parameters [25].

$$y_{it} = \alpha + x_{it}\beta' + \mu_{it}$$

Individual specific effects can be retrieved after estimation such as:

$$\hat{\alpha}_i = \overline{y}_i - \overline{x}_i\hat{\beta}$$

In other words, the specific effects of each individual are the excess variation of the dependent variable that the regressors cannot explain. Time dummy variables can be included in the x regressors.

Random-effects model

The random-effects model assumes that the specific effects of each individual α_i are distributed independently of the regressors. A_i was included in the error term. Each individual has the same slope parameters and a composite error term [3]:

$$\varepsilon_{it} = \alpha_i + e_{it}$$

Therefore, the following equation is established based on the above information:

$$y_{it} = x'_{it}\beta + (\alpha_i + e_{it})$$

$$\text{Here } var\ (\varepsilon_{it}) = \sigma_a^2 + \sigma_e^2 \text{ y } cov\ (\varepsilon_{it}, \varepsilon_{is}) = \sigma_a^2$$

$$\text{Then } \rho_\varepsilon = cor\ (\varepsilon_{it}, \varepsilon_{is}) = \sigma_a^2/(\sigma_a^2 + \sigma_e^2)$$

Rho is the correlation between classes of the error. Rho is the fraction of the variance in the error due to the specific effects of each individual. It approaches 1 if the individual effects dominate the idiosyncratic error. Based on the above, the following model with panel data is proposed as follows:

$$LREVENUES = \beta_0 + \beta_1 LACADEMICPERSONNEL + \beta_2 LADMINISTRATIVEPERSONNEL + \varepsilon$$

Where:

LREVENUES: Total income from universities

LACADEMICPERSONNEL: Salaries of the professors.

LADMINISTRATIVEPERSONNEL: Salaries of the administrative staff.

ε: Term of error.

The use of natural logarithms for the variables on both sides of the econometric specification is called a log-log model. This model is useful when the relationship is not linear in the parameters because the logarithmic transformation generates the desired linearity in the parameters (it can be remembered that linearity in the parameters is one of the OLS assumptions).

In principle, any logarithmic transformation (natural or not) can be used to transform a model that is not linear in parameters into a linear one. All logarithmic transformations produce similar results, but the convention in the applied econometric work is to use the natural logarithm. The practical advantage of the natural logarithm is that the interpretation of the regression coefficients is simple. The coefficients in a log-log model represent the elasticity of variable Y with respect to variable X. In other words, the coefficient is the estimated percentage change in the dependent variable for a percentage change in the independent variable [8].

Results

The following section presents the evolution of the expenditure for the salary of professors for the Universidad Laica Vicente Rocafuerte (ULVR), Universidad Politécnica Salesiana (UPS) and Universidad Católica Santiago de Guayaquil (UCSG). In the case of the ULVR, its expenditure has recorded an increasing trend, with 4.86 million dollars spent in 2017; By 2020, the figure increased by $ 5.17 million at an average annual growth rate of 2%, and the average expenditure for the salary of professors was $ 4.99 million. Regarding the UPS, its expenditure has recorded an increasing trend, with 23.56 million dollars spent in 2017; By 2020, the figure increased by $ 37.15 million at an average annual growth rate of 31%, and the average expenditure was $ 36.82 million. Finally, in relation to the UCSG, its expenditure has recorded a decreasing trend, with 18.34 million dollars spent in 2017; For 2020, the figure decreased by $ 14.40 million at an average annual growth rate of -7%, and the average expenditure was $ 15.69 million (table 1).

Table 1. Evolution of the expenditure for the salary of professors during the 2017-2020 period (ULVR, UPS and UCSG universities)

Year	ULVR
2017	$4.863.968,55
2018	$4.900.747,93
2019	$5.054.028,61
2020	$5.169.884,16
Average	**$4.997.157,31**

Note. Comprehensive income statement and executed budgets of the universities.

The evolution of the expenditure for the salary of professors of Universidad del Azuay (UA), Universidad Tecnológica Equinoccial (UTE), and Universidad Técnica Particular de Loja (UTPL) is presented in table 2. In the case of the UA, its expenditure has recorded a decreasing trend, with 14.31 million dollars spent in 2017; for 2020, the figure decreased by 13.61 million dollars at an average annual growth rate of -1%, and the average expenditure for the salary of professors was $ 14.86 million. Regarding the UTE, its expenditure has recorded a decreasing trend with 30.89 million dollars spent in 2017; for 2020, the figure decreased by 25.30 million dollars at an average annual growth rate of -5%, and the average expenditure was $ 31 million. Finally, in relation to the UTPL, its expenditure has recorded a growing trend with 25.96 million dollars spent in 2017; for 2020, the figure increased by 30.08 million dollars at an average annual growth rate of -5%, and the average salary expenditure was $ 28.37 million (table 2).

Table 2. Evolution of the expenditure for the salary of professors during the 2017-2020 period (UA, UTE and UTPL universities)

Year	UA	Growth rate	UTE	Growth rate	UTPL	Growth rate
2017	$14.307.552,00		$30.886.455,00		$25.964.380,00	
2018	$15.390.564,00	8%	$37.555.249,90	22%	$27.639.740,00	6%
2019	$16.116.646,44	5%	$30.273.952,00	-19%	$29.796.100,00	8%
2020	$13.614.210,20	-16%	$25.304.210,00	-16%	$30.083.960,00	1%
Average	**$14.857.243,16**	**-1%**	**$31.004.966,73**	**-5%**	**$28.371.045,00**	**5%**

Note. Comprehensive income statement and executed budgets of the universities.

The evolution of expenditure for the salary of the administrative personnel of the ULVR, UPS, and the UCSG is presented in table 3. In the case of the ULVR, its expenditure has recorded an increasing trend, with 1.73 million dollars spent in 2017; for 2020, the figure increased by $ 1.82 million at an average annual growth rate of 3%, and the average expenditure was $ 1.87 million. Regarding the UPS, its expenditure has recorded a fluctuating trend, with 5.20 million dollars spent in 2017; for 2020, the figure increased by $ 9.78 million at an average annual growth rate of -47%, and the average expenditure was $ 6.06 million. Finally, with respect to the UCSG, its expenditure has recorded an increasing trend, with 4.70 million dollars spent in 2017; for 2020, the figure grew by $ 4.80 million at an average annual growth rate of 1%, and the average expenditure was $ 4.88 million (table 3).

Table 3. Evolution of the expenditure for the salary of administrative personnel during the 2017-2020 period (ULVR, UPS and UCSG universities)

Year	ULVR	Growth rate	UPS	Growth rate	UCSG	Growth rate
2017	$1.726.062,86		$5.200.162,15		$4.704.727,01	
2018	$1.786.030,23	3%	--	-100%	$4.887.156,17	4%
2019	$2.128.310,31	19%	$9.252.292,04		$5.112.115,16	5%
2020	$1.827.186,85	-14%	$9.783.454,00	6%	$4.800.310,71	-6%
Average	**$1.866.897,56**	**3%**	**$6.058.977,05**	**-47%**	**$4.876.077,26**	**1%**

Note. Comprehensive income statement and executed budgets of the universities.

The evolution of the expenditure for the salary of the administrative personnel of the UA, UTE, and the UTPL is presented in table 4. In the case of the UA, its expenditure has recorded a decreasing trend, with 6.13 million dollars spent in 2017; for 2020, the figure increased by $ 5.83 million at an average annual growth rate of -1%, and the average expenditure was $ 6.37 million. Regarding the UTE, its expenditure has recorded a fluctuating trend, with 9.31 million dollars spent in 2017; for 2020, the figure increased by $ 9.57 million at an average annual growth rate of -55%, and the average expenditure was $ 7.38 million. Finally, concerning the UTPL, its expenditure has recorded an

increasing trend, with 12 million dollars spent in 2017; for 2020, the figure grew by $ 10.57 million at an average annual growth rate of 5%, and the average expenditure was $ 9.67 million (table 4).

Table 4. Evolution of the expenditure for the salary of administrative personnel during the 2017-2020 period (UA, UTE and UTPL universities)

Year	UA	Growth rate	UTE	Growth rate	UTPL	Growth rate
2017	$6.131.808,00		$9.305.705,00		$9.122.620,00	
2018	$6.595.956,00	8%	$-	-100%	$9.711.260,00	6%
2019	$6.907.134,19	5%	$10.655.080,00		$10.468.900,00	8%
2020	$5.834.661,51	-16%	$9.571.546,00	-10%	$10.570.040,00	1%
Average	**$6.367.389,93**	**-1%**	**$7.383.082,75**	**-55%**	**$9.968.205,00**	**5%**

Note. Comprehensive income statement and executed budgets of the universities.

Share of salaries of the academic and administrative personnel in the co-financed universities is presented in table 5. Professor salaries at Universidad Laica Vicente Rocafuerte represented 25% of the total income, while administrative salaries represented 9% of the total income. Professor salaries at Universidad Politécnica Salesiana represented 46% of the total income. Conversely, administrative salaries comprised 12% of the total income. Regarding professor salaries at Universidad Católica Santiago de Guayaquil, these represented 18% of the total income, while administrative salaries comprised 6% of the total income. Regarding professor salaries at Universidad del Azuay, these represented 47% of the total income, and administrative salaries represented 20% of the total income. With regards to professor salaries at Universidad Tecnológica Equinoccial, these represented 56% of the total income, and administrative salaries comprised 19% of the income. Finally, professor salaries at Universidad Técnica Particular de Loja represented 48% of the total income, and administrative salaries represented 17% of the total income (table 5).

Table 5. Share of salaries on the income of the universities

Universities	Academic personnel	Administrative personnel
Universidad Laica Vicente Rocafuerte	25%	9%
Universidad Politécnica Salesiana	46%	12%
Universidad Católica Santiago de Guayaquil	18%	6%
Universidad del Azuay	47%	20%
Universidad Tecnológica Equinoccial	56%	19%
Universidad Técnica Particular de Loja	48%	17%

Note. Comprehensive income statement and executed budgets of the universities

Figure 1 shows the dispersion between the income of the universities and the expenditure for professor salaries. The graph suggests a positive relationship between both study variables. Therefore, an increase in expenditure for professor salaries implies an increase in the income of the co-financed universities (Figure 1).

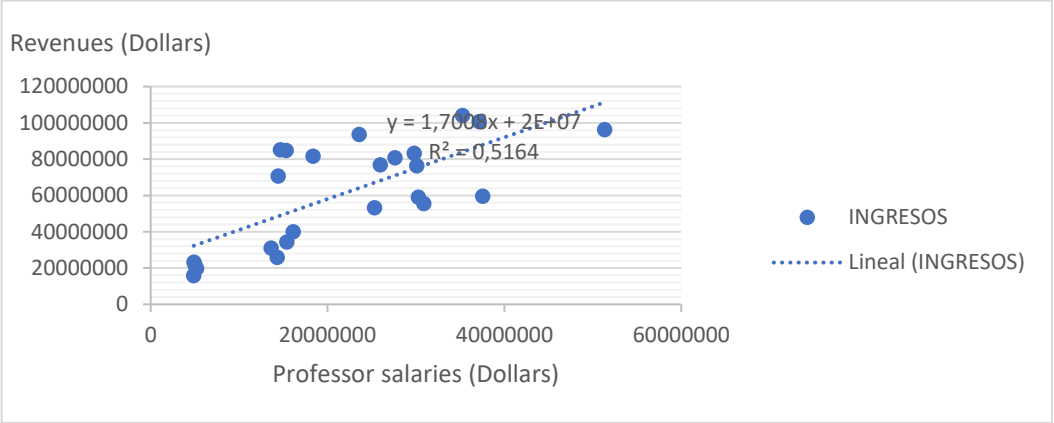

Figure 1. Scatter plot for university income and expenditure for professor salaries.

Figure 2 shows the scatter plot for the income of the universities and the expenditure for the salary of the administrative personnel. As in figure 1, it is evident that there is a positive relationship between both study variables, so that an increase in the expenditure for the salary of the administrative personnel leads to growth in the income of the co-financed universities.

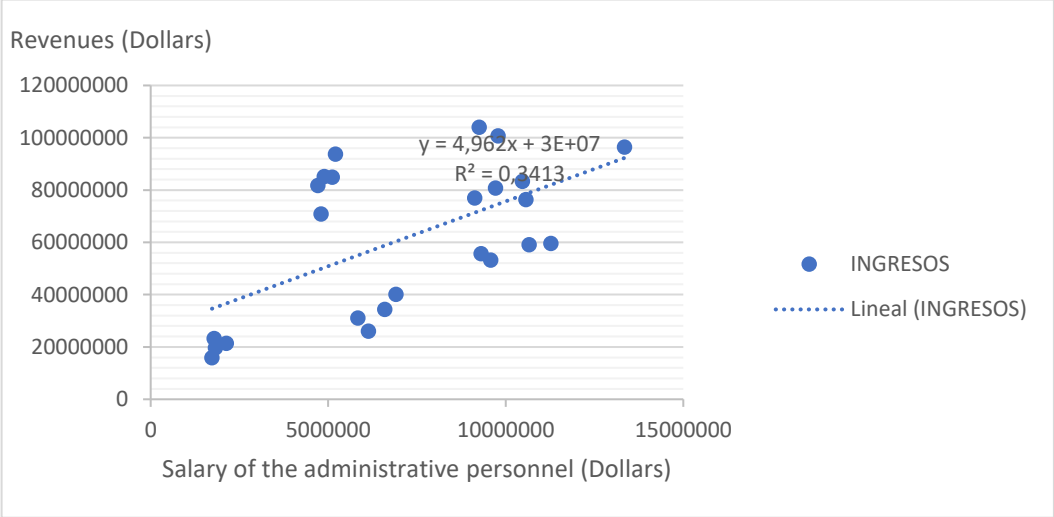

Figure 2. Scatter plot for university income and expenditure for the salary of the administrative personnel.

The results of the econometric models at the individual university level are presented in table 6. The results of the first model for the revenues of the universities and the expenditure for professor salaries suggest that the universities that contributed to higher growth in their income from the expenditure for professor salaries are: Universidad Politécnica Salesiana and Universidad Católica Santiago de Guayaquil, with coefficients of 15.33% and 15.28% respectively. On the other hand, the

universities that showed the lowest performance were: Universidad del Azuay and Universidad Laica Vicente Rocafuerte, with coefficients of 14.38% and 14.08% respectively. At the group level, it is observed that for every 1% increase in professor salaries, university revenues increase by 0.18%. However, the variable is not statistically significant (Table 6).

Likewise, table 6 shows the results of the second model for the university revenues and the expenditure for the salary of the administrative personnel. It is suggested that the universities that contributed to higher growth in their income from the expenditure for professor salaries are: Universidad Politécnica Salesiana and Universidad Católica Santiago de Guayaquil, with coefficients of 15.70% and 15.60% respectively. However, the universities that recorded the lowest yields were: Universidad del Azuay and Universidad Laica Vicente Rocafuerte, with coefficients of 14.66% and 14.36% respectively. At the group level, it is observed that for every 1% increase in administrative salaries, university income increases by 0.17%. However, the variable is not statistically significant.

Table 6. Results of the econometric models

Universities	**Model 1**	**Model 2**
Pooled model	0.18	0.17
Universidad Laica Vicente Rocafuerte	14.08***	14.36***
Universidad Politécnica Salesiana	15.33**	15.70***
Universidad Católica Santiago de Guayaquil	15.28***	15.60***
Universidad del Azuay	14.38***	14.66***
Universidad Tecnológica Equinoccial	14.81***	15.13***
Universidad Técnica Particular de Loja	15.16***	15.46***

Significance: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

To validate the proposed models, the diagnostic tests shown in Table 7 were performed. The results showed that both models presented heteroscedasticity problems. Therefore, in both models, the White contrasts were used to correct heteroscedasticity. As a matter of fact, both econometric models meet the regression assumptions.

Table 7. Diagnostic tests

Diagnostic Tests	**Model 1**	**Model 2**
Breusch-Godfrey (Autocorrelation)	0.7584	0.7353
Durbin-Watson (Autocorrelation)	0.2199	0.2221
Breusch-Pagan (Heterocedasticity)	0.1886	0.2133
NCV Test (Heterocedasticity)	0.0022049*	0.003415*
Test RESET de Ramsey (Especification)	0.1318	0.07491
Jarque-Bera (Normality of the errors)	0.4154	0.437

Note. * Heterocedasticity presence.

Once the individual effects of the variables have been studied, the grouped effects are estimated using the panel data. Table 8 shows the coefficients of the variables estimated through the OLS models, the grouped model, the fixed and random effects model, where it is observed that for the first two models, the salary of the academic and the administrative personnel are statistically significant, while for the independent variables the fixed and random effects models are not significant.

Table 8. Panel data model

Revenues	**OLS**	**Regression of the grouped model**	**Fixed-Effects Regression**	**Random-Effects Regression**
Constant	7.1013***	7.10128***		10.928072***
Professor salaries	1.6288***	1.62883***	0.061885	0.494348
Salaries of the administrative personnel	-1.0582**	-1.05819**	0.119963	-0.089563

Significance: *,**,*** significance levels of 10%, 5% and 1% respectively

With regards to the selection of the best model, the following diagnostic tests were used: the Lagrange FF multiple test, the individual F test or effects over time, and the Hausman test for panel models. In this sense, the Lagrange test suggests using the fixed effects on the OLS model, while the F test maintains that the random effects should be used on the pooled model. Finally, the Hausman test shows a p-value of 0.0576, where the null hypothesis of selecting the fixed effects is rejected, and it is concluded that the random effects should be used.

Coefficients can be interpreted from the selected model: the 1% increase in expenditure for the salary of professors leads to an average increase in income of 0.49%. While the increase of 1% in the expenditure for the salary of the administrative personnel leads to a reduction of -0.08% in the university revenues. However, both variables are not statistically significant.

Table 9. Model selection tests

Test	p-Value
Lagrange FF Multiplier Tests for Panel Models	0,0006816
F Test for Individual and/or Time Effects	0,07174
Hausman Test for Panel Models	0.0576

Discussion

To contrast the hypotheses H1 and H2, which affirm that the expenditure for the salaries of the academic and administrative personnel positively influence the revenues of the co-financed universities in Ecuador, two multiple linear regression models have been used to estimate the individual effects: the dependent variable (revenues), and the independent variables (expenditure for the salary of the academic and the administrative personnel), which have been measured in dollars. Additionally, a panel data model with random effects was used to observe the effects between these variables.

Regarding the results of the panel data econometric model, the conditions of the hypotheses raised are partially fulfilled, suggesting that the expenditure for the salary of professors has a positive impact on the revenues of the co-financed universities. However, expenditure for the salary of administrative personnel has a negative impact on universities. It should be noted that, in both cases, the independent variables are not statistically significant [23].

The greatest challenge initial academic training faces is attracting the best talent and constantly raising the quality of the training processes. This seems to be inseparable from the development of national academic training standards that are clearly established for academic training institutions, a definition of what a graduate should know and be able to do, along with an institutional framework that ensures the quality of the processes. Regarding continuous training, as mentioned above, the horizon of change points to the higher value of training processes based on collaborative and professional development strategies, more strongly based on school teams than on individual professors. In addition, the change in this area rests on methodologies capable of linking, in a much more consistent way than until now, the realities of day-to-day teaching with the courses, workshops, and innovation experiences offered by the continuous training programs offered in different countries [10].

Regarding the initial and continuous training of professors, policies that contemplate inequality and the potential of education to level the social distribution of key capacities and contribute to a common cultural base conducive to more cohesive societies should privilege strategies and content that explicitly seek to provide what is needed to produce learning and growth among children and young people from marginalized and poor areas and communities. This is not part of the patterns that have been identified, and this vacuum constitutes a great challenge ahead [21].

As a result of the ambitious policy developments around higher education in Ecuador, professors with advanced degrees have become fundamental in achieving institutional quality and knowledge production. In addition, state focus on innovation, technology, science, and its emphasis on knowledge production place administrators in a complex nexus of relationships between the government, public and private universities, and the academic personnel [7].

The training of professors to carry out research in Ecuador will also affect recruitment, hiring, and retention in the future. Due to the lack of emphasis and knowledge of research methodologies in Ecuador, many professors will suffer from finding and maintaining teaching positions without the capability to research within the current framework. Research skills need to be instilled in undergraduate programs in Ecuador to ensure a well-informed workforce in the future [1].

Conclusions

The objective of this research work was to analyze the effect of the expenditure for the salary of the academic and administrative personnel on the income of the co-financed universities in Ecuador during the 2017-2020 period. Responding to this goal is especially important in public sector contexts, where unconditional salary increases in benefit enhancement are often questioned. However, there is little evidence on this issue, and there is no literature on the market test to corroborate its implementation in practice.

With respect to the evolution of the salary expenditure for university professors, during the study period, it could be observed that the ULVR recorded an average of 4.99 million dollars at an average growth rate of 2%, while the UPS recorded an expenditure average of 36.82 million dollars at a rate of 31%. The average expenditure of the UCSG was $ 15.69 million at an average annual growth of -7%. As for the UA, the average expenditure was 14.86 million dollars at an average growth rate of -1%, while the average expenditure of the UTE was 31 million dollars at a rate of -5%. Finally, the average expenditure of the UTPL was 28.37 million dollars at an average annual growth of 5%.

Regarding the evolution of the expenditure for the administrative salaries of the universities, it was observed that during the study period the ULVR recorded an average of 1.87 million dollars at an average growth rate of 3%, while the UPS recorded an average expenditure of $ 6.06 million at a rate of -47%. The average expenditure of the UCSG was $ 4.88 million at an average annual growth of 1%. As for the UA, its average expenditure was 6.37 million dollars at an average growth rate of -1%.

While the average expenditure of the UTE was 7.38 million dollars at a rate of -55%. Finally, the average expenditure of the UTPL was 9.97 million dollars at an average annual growth of 5%.

The present work used two models, multiple linear regression and panel data. The results of the first model suggest that Universidad Politécnica Salesiana and Universidad Católica Santiago de Guayaquil are the institutions that benefited from the increase in the salaries of the academic and the administrative personnel, which led to revenue growth. While the universities that showed the lowest performance were Universidad del Azuay and Universidad Laica Vicente Rocafuerte.

On the other hand, the results of the analysis of the grouped effects of the co-financed universities were measured utilizing panel data with random effects, where the 1% increase in the variable professor salaries leads to an average increase in income by 0.49%. On the other hand, the 1% increase in administrative salaries leads to a -0.08% reduction in university income. However, both variables are not statistically significant.

Therefore, policymakers hoping to increase the quality of public service by raising wages must offset these potential benefits in the wide margin with the large costs of the intensive margin of unconditional increases in public sector wages, which may not produce any improvement in revenues. The results of this study are likely to be relevant in a wide range of public sector settings, and especially in developing countries.

The vocation of teaching and the commitment to constant and continuous preparation produces a quality higher education. It is also worth emphasizing that these values represent an economic value in the budget line justifies the investment in salaries.

The role of the professor to incorporate professionals who contribute positively to society when the latter requires them, who are good professionals and honest citizens, should have great significance within the social construct, so their economic valuation is justified within the budget of each one of the universities analyzed.

The wages received by professors provide them financial and family stability, health, and motivation to continue with their invaluable activity.

Study limitations

There is a vacuum in the literature due to the absence of studies that measure through econometric models the impact of the salaries of the academic and administrative personnel in relation to the revenues of the universities. As a result of this, the discussion of the results became difficult.

Future lines of research

Research should be carried out on the performance of the administrative staff and especially the academic staff in the co-financed universities as a result of the increase in their salaries. As a result of this, an in-depth study of the impact this has on student performance should be carried out.

Chapter 3. Influence Of The Salaries Of The Academic Personnel Of The Co-Financed Universities On The Number Of Scientific Publications.

Chapter 3. Influence Of The Salaries Of The Academic Personnel Of The Co-Financed Universities On The Number Of Scientific Publications.

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Abstract

Ecuador has dramatically increased its scientific production in recent years, currently ranking sixth in Latin America and the Caribbean, with the highest number of scientific publications featured in Scopus. The objective of this paper is to contribute to the debate on the determining factors of the individual scientific production, with particular emphasis on the salary of the academic personnel from co-financed universities in Ecuador. The panel data model was employed to observe individual and group effects. The results of this research suggest that the increase of the variable graduate teaching assistant salaries by 1% leads to a decrease in the publication of scientific literature by -4.50%. On the other hand, concerning the adjunct instructor salaries, the 1% increase leads to a 13.12% increase in the publications of scientific literature. Finally, concerning professor salaries, the increase of 1% implies an average growth rate of 0.98%. What is innovative about this paper is that it is a study that seeks to analyze the impact of the academic personnel salaries on their scientific performance and confirm whether income is a fundamental factor for the publication of more scientific papers.

Keywords: Academic personnel salaries, scientific publications, co-financed universities.

Jel classification: I23, J3, O3

Introduction

The improvement of public education has gained increasing attention not only in Ecuador but worldwide. One reason is the fundamental role that education plays in determining both individual income and overall economic growth. Another reason is the widespread discontent over the performance of the education sector in recent years: a substantial increase in public education spending has failed to generate the corresponding improvement in student performance.

Few beliefs in academia demand a more passionate allegiance than the view that teaching and research are harmonious and mutually beneficial pursuits (Galbraith and Merrill 2012; Ramsden and Moses 1992; Taylor 2007). However, the extensive and long-standing empirical evidence hardly

supports a positive relationship between research and teaching performance. In their meta-analysis of 58 empirical studies, Hattie and Marsh (1996) find no such relation. Marsh and Hattie (2002) conclude that the common belief that research and teaching are inextricably intertwined is nothing more than a popular myth. Recently, the focus of research has turned to think about how the relationship could or should work (Malcolm 2014).

While most universities emphasize their dual teaching and research mission (Taylor, 2007), formally established objectives are often not translated into reward strategies and systems (Modell, 2003). Performance evaluation in academia has traditionally been somewhat biased towards research indicators, and this orientation appears to be deepening (Bogt and Scapens, 2012; Gendron, 2008; Parker, 2008). A growing number of reports document that universities striving for government funding, research grants, and high rankings have adopted strategies that include recruiting and reward systems that favor scholars with the best publications or the potential to secure such publications (Bogt and Scapens, 2012; Douglas, 2013; Gendron, 2008; Hopwood, 2008; Long et al., 2009; Parker, 2012; Sangster, 2011).

These developments have significant implications for organizational and individual research strategies (Besancenot, Faria, and Vranceanu, 2009; Moll and Hoque, 2011; Reidpath and Allotey, 2010; Rodman, Biloslavo and Bratoz, 2013; Cadez, 2013; Gendron, 2008; Hopwood, 2008). Publishing-or-perishing is becoming the predominant strategy, while strategies like teaching-or-accusing and publishing-and-teaching-effectively are being marginalized (Hattie and Marsh, 1996). Besancenot, Faria, and Vranceanu (2009) and Bogt and Scapens (2012) warn that current advances in performance assessment can be detrimental to creativity and innovation in teaching. A research-based performance appraisal system provides an incentive for rational actors to economize on teaching efforts to improve their career prospects (Arnold, 2008; Gendron, 2008; Moya, Prior, and Rodríguez-Pérez, 2015).

One of the least studied and most perplexing aspects of this debate is the question of individual scientific productivity. The teaching activity is basically an activity of multiple products, which results in research, teaching, and other products (press articles, medical protocols, etc.) with a relevant impact on society. This idea is so widespread that, during national research evaluation exercises, such as the British Research Excellence Framework 2014, information is collected on all these different activities to assess not only the quality of the research produced by universities but even its many facets and social impact. As far as is known, no study addresses the issue of determinants of the overall production of researchers, even if numerous papers are focused only on one dimension of their multiple results activities.

The idea that scientific publications represent the essence of the research activity is widely accepted (Wooton, 2013). Two different streams of literature have developed in this regard. The first current

focuses on describing the laws that underlie the frequency distribution of research publications, following the tradition started by Lotka (1926). The second stream deals with the determinants of individual productivity. These works aim to define the factors that affect research productivity through correlation analysis or regression modeling tools.

A common characteristic of this type of literature is based on consideration of the number of publications of a professor as a proxy to quantify his performance. The main drawback of this indicator lies in the fact that each publication counts as a short article that addresses a limited topic counts as a fundamental article. Therefore, the holy grail of scientometric research is the construction of indicators that address, at the same time, the issue of productivity and the quality of scientific work at the researcher level (Van Leeuwen et al., 2003). To his effect, the strategy most used in empirical research consists of replacing the notion of research quality with the notion of scientific impact that can be more easily handled using citation data, as defined by Martin and Irvine (1983). A first possible approach may be based on counting a subset of academic publications, such as highly cited articles or those published in top journals, thus defined in reference to the impact factor or other similar indicators. A different approach aims at obtaining composite indicators of productivity and impact of a researcher considering his published papers, as well as the citations of his researches.

Ecuador has dramatically increased its scientific production in recent years and currently ranks sixth in Latin America and the Caribbean with the highest number of papers published in Scopus. (Moreira, Morales, Crespo-Gascón, & Guerrero, 2020). This is because universities in the country have undergone a series of changes that have made their role and relationship with society vary in a certain way. These changes have contributed to the construction of a new public policy framework and the conception of a new scenario in the fulfillment of development objectives (Toscanini, Aguilar, & García, 2016). This arises from the incorporation of the Social Democratic State with the 2008 Constitution, which in its article 350 establishes that: “The higher education system aims at academic and professional training with a scientific and humanistic vision; scientific and technological research; innovation, promotion, development, and dissemination of knowledge and cultures; the search for solutions for the problems of the country in relation to the objectives of the development regime.”

This paper aims to contribute to the debate on the determinants of individual scientific production, emphasizing the attention to professor salaries of the co-financed universities of Ecuador. There is a void on how professor salaries influence performance, with particular emphasis on the number of papers published in Scopus, within the framework of Ecuadorian universities.

This paper is structured as follows: The theoretical framework is in the first section, where it is detailed how research performance, professor salaries, performance-based pay, differences in salary regimes, and models of academic salaries are measured. In the second section, the study methodology goes into detail. To this effect, the panel data model was employed to observe the individual and group

effects. Subsequently, the results are established from the models established in the methodology. Subsequently, the results are discussed, and the study is finally concluded.

Theoretical framework

1.1.Research performance indicators in the academic field

The general literature on performance management advocates that to ensure the effective implementation of the strategy, the performance measures of an organization must be aligned with its strategic objectives (Cadez and Guilding, 2008; Chenhall, 2005; Choi, Hecht and Tayler 2013; Ferreira and Otley, 2009; Rejc and Zaman, 2012). In the academic context, one would expect a balance between performance evaluation measures related to research and performance evaluation measures related to teaching.

Bogt and Scapens (2012) report a lack of literature on performance measurement systems in universities. Nevertheless, ample evidence corroborates that research is valued more than teaching (Gomez-Mejia and Balkin, 1992; Katz, 1973; Konrad and Pfeffer, 1990) and that many universities are giving increasing importance on research performance indicators for promotion, permanence, compensation, performance, and evaluation purposes (Arnold, 2008; Bogt and Scapens, 2012; Douglas, 2013; Gendron, 2008).

In the United States, college compensation systems provide tangible evidence that research is valued more than teaching. Gómez-Mejía and Balkin (1992) found that in the United States, the number of publications in top-level journals was a major determinant of academic remuneration. In particular, they also investigated the effectiveness of teaching as a determinant of academic salaries, thus, providing empirical evidence of a positive relationship between teaching effectiveness and remuneration. Although this effect only applies to the segment of professors with outstanding research records. Therefore, superior teaching performance is only reflected in a higher salary when a certain threshold of research quality is reached. In contrast, Konrad and Pfeffer (1990) found no relationship between teaching performance and academic remuneration.

The tangible indicators that reflect the value of research in the European context are more diverse. Bogt and Scapens (2012) report that while quality research in the UK and the Netherlands may not generate direct financial benefits, it has an indirect impact through faster promotions and job offers from other universities. In the UK, most universities require excellence in research for the highest and most prestigious degrees (as a professor) and do not consider applications for such positions based on teaching activities (Parker, 2008). The personal experience of Sangster (2011) is consistent with the finding of Parker (2008), who states that in all the stages of his career, as of his first academic appointment, promotions, salary increases, and appointments have been considered, for the most part, based on the quality of research. Additionally, many universities reward quality research with financial

bonuses. As reported by Olsson (2013), an outstanding publication is rewarded with a bonus of 20,000 euros at the BI Business School in Norway; however, the school does not mention similar bonuses for high-quality instruction. Progressively, many universities reward quality research with a lower teaching load.

Despite relatively little empirical research, Hattie and Marsh (1996) noted that the few studies in their meta-analysis that used quality indicators for research performance revealed a slight positive relationship with teaching effectiveness. In addition, Stack (2003) found a significant positive relationship between the quality of research, measured by citations, and teaching evaluations conducted by students. In a more recent study, Stanton, Taylor, and Stanalan (2009) found that publication in prestigious academic journals contributes significantly to positive perceptions of the teaching experience by students. It is also noteworthy that Gómez-Mejía and Balkin (1992) find a positive relationship between teaching effectiveness and salaries that depend on outstanding research. Taken together, this suggests that excellent research is consistent with the quality of teaching, and, therefore, the following hypothesis is postulated:

H1: The salaries of professors have a positive influence on the number of scientific publications.

1.2.Academic compensation

Payment for performance aims to solve the double problem of motivating high academic achievement while attracting and retaining good professors in conditions where their effort or ability is not easily measured or observed. In the academic profession, income is based primarily on inputs (i.e., skills and time worked) rather than output. Such a foundation, critics say, is not results-oriented. In the academic profession, effort and output are difficult to define and measure because work is generally complex, unique, and often the result of team efforts, and it is difficult to separate the individual effort of a professor from the team effort.

Fortunately, several recent studies find that high-quality scholars respond to incentives. Biasi (2019) finds that districts that adopted flexible pay are more likely to have higher added value scholars because young, high added value scholars who were poorly paid in relation to their productivity left the hard-pay districts and joined the flexible payment districts, based on effectiveness. Macartney, McMillan, and Petronijevic (2018) using longitudinal data from North Carolina show that scholars improve their added value under incentive-oriented policies. Based on a discrete choice experiment, Johnston (2018) finds that high added value scholars prefer the merit payment model in contrast to low added value scholars. Given these findings that financial incentives play an important role in attracting and retaining high-quality scholars, understanding their decisions about career paths will shed light on how to structure the academic compensation that elevates the quality of scholars and improves educational results.

1.3.Performance-based pay

Performance-based pay generally involves an objective evaluation of the efforts or success of the institutions or scholars or some measure for the student performance. Performance-based payment schemes have many variable characteristics. They can compensate scholars based on their performance solely, or they can be structured as a team incentive program, with group performance determining the total incentive pay, which is then divided among team members regardless of individual performance. The group can include all the academic personnel of the school or a subgroup, such as professors who teach a specific course or subject. Performance-based payment schemes may, but not necessarily, involve penalties for performance below the threshold. Although monetary rewards are the most common incentive in performance-related pay, other incentives may include reduction of teaching load, promotion, and the public recognition of outstanding scholars. The reward can be just a one-time event, or it can be continuous, leading to a permanent salary increase. It can be based on a relative criterion (for example, the average test score of a class in relation to another class) or on an absolute criterion (such as the average test score of the class is above a predetermined threshold). The reward can be a lump sum that is the same for all winners, or it can vary and increase according to the level of achievement. The total amount of prizes can be predetermined (for example, only a certain number of professors can win a prize) or it can be open. Performance criteria can include results for professors themselves, such as measures of absenteeism or performance on a test. They may also include student performance measures, such as attendance, grade repetition, dropout rates, or test performance. These criteria are not mutually exclusive.

1.4.Differences in salary regimes

The reward structure in the science field consists of two components (Stephan, 2010). First, science is governed by the priority system, a reward system that encourages the production and sharing of knowledge. Scientists are motivated to conduct research moved by the desire to prioritize discovery because recognition in science depends on being first (Stephan, 1996, 2010). Secondly, the reward structure in science consists of remuneration. Academic positions provide both extrinsic rewards (salaries and other material benefits) and intrinsic rewards (derived from academic work) (Blau, 1994; Stern, 2004). Low salaries are a major impediment to effective academic recruitment. National academic labor markets determine who the scholars are and whom they will become in the future. They produce or do not produce the talent needed in academia (Williams et al., 1974; Fairweather, 1995).

Institutions with more open salary systems, especially in the United States, are better able to attract high-quality researchers from institutions with less open salary systems, particularly those in continental Europe. Scholars in much of continental Europe are typically still civil servants who are mostly paid on the basis of a single well-defined fixed salary system (Altbach et al., 2012).

Consequently, universities in the United States have greater leeway to reward performance and pay high salaries to attract star researchers (Stephan, 2012). However, in the last two decades, most European systems have tended to introduce various forms of merit pay, tardily moving away from fixed salary systems (Enders, 2004), and national case studies (Altbach et al., 2012).

1.5.Academic salary models

Existing theories about academic remuneration can be classified into market models and institutional models, which consider academic remuneration as a function of market competition or institutional forces, respectively (Fairweather, 2005). Two market models attribute changes in professor salaries, at least in part, to changes in supply and demand: one school emphasizes the homogeneity of national academic markets based on research and prestige (research production is highly valued in research-oriented institutions and higher research performers are paid more), and the other school emphasizes the segmented nature of national academic markets (teaching-oriented institutions value teaching over research, and the best professors are paid more.) Institutional theories of academic compensation emphasize that compensation is an expression of institutional norms and values, regardless of institutional missions, and that institutional forces can dictate salary levels: Institutions that truly value teaching will pay their productive professors more, while institutions that value research will pay their productive researchers more (Fairweather, 2005). In a standard human capital model (used by Hamermesh et al. (1982)), academic income is a function of research productivity (on the demand side), as well as any factor affecting labor supply balance. Professor salaries are also considered indirectly related to productivity because the most productive academics are likely to be promoted faster and promotions mean greater financial rewards.

The participation of scientists in research can be investment-driven (seeking future financial rewards), consumption-driven (seeking research puzzles), or both (Thursby, et al., 2007). Although the investment motive implies a decrease in research productivity throughout the career, the consumption motive does not imply such a decrease (Stephan P. E., 1992). The taste for science, that is, for non-pecuniary benefits, makes scientists choose academia over industry (Roach, 2010). Academics with different abilities and tastes in terms of non-pecuniary returns choose different careers: basic or applied research in academia or industry (Agarwal, 2012). Time spent on research reduces current earnings, but increases future earnings, as in human capital investment models. On average, scientists become less productive as they age and changing research productivity throughout the life cycle and productivity in systems with aging academic cohorts are important research focuses (Over 1982; Kyvik 1990; Levin and Stephan 1991; Stephan and Levin 1992).

From the perspective of higher education economics, specifically labor economics concepts, academic compensation is influenced by several factors related to the demand for higher education services and the supply of qualified individuals for teaching positions (Toutkoushian, 2016). From this

perspective, academics have acquired human capital (skills and talents an individual can obtain through education, training, and experience in the labor market) and gifted human capital (natural ability and talent) (Toutkoushian, 2016). There can be large variations in the academic levels of both types of human capital in academic labor markets. The connection between human capital and academic salaries stems from the effects of human capital on productivity, which in turn influences remuneration (Toutkoushian, 2016). As Toutkoushian and Paulsen (2016) point out, if academic compensation is determined in part by the individual productivity in teaching, research, and public service, then wages must be correlated with productivity. Thus, the human capital theory would predict that scholars with more acquired and gifted human capital would, on average, have higher salaries than other scholars.

The economic models for determining the academic salary have been based predominantly on the theory of human capital (incorporated in the analyzes of for-profit companies and consequently in higher education institutions); in the prestige model of salary determination, universities behave both as companies and as non-profit institutions or hybrids (Melguizo, 2007). In the prestige model, academic salaries are viewed as a prestige generation return (for both the scholar and the institution). Non-profit higher education institutions act largely as prestige maximizers, just as for-profit companies act as profit maximizers. Not only institutions seek to maximize prestige, but also departments and members of the school (Melguizo, 2007). While human capital salary models focus on research, teaching, and public service productivity, a potential alternative model focuses on the generation of the prestige of people, mainly through publications, research grants, patents, and awards, that is, productivity. Both the human capital model and the prestige model claim that higher productivity (defined for different areas, with publications at the forefront) should lead to higher academic earnings.

Prestige is predominantly a rival good, based more on relative measures than absolute measures; accumulating prestige is a zero-sum game (Brewer et al., 2002). Academia is becoming increasingly competitive, and competitiveness is fostered by deliberate government policies. At the center of all this is prestige, at all levels, from the national to the individual system (Blackmore, 2016). Universities, as well as scholars, compete in prestigious markets. In particular, there is a strong link between individual and institutional prestige. By maximizing individual prestige, faculty members simultaneously maximize the prestige of their departments and institutions (Melguizo, 2007).

Following the logic of this salary model, in the context of this research, highly productive academics should be disproportionately overrepresented among highly-paid academics. Because more time spent teaching means less time spent researching and vice versa, there are only investments of research time and no research, so academics who spend more time on average research should receive higher average salaries (Levin, 1991). Spending more time teaching, in turn, should have a negative or, at best, a

neutral effect on wages (Katz 1973; Dillon and Marsh 1981; Konrad and Pfeffer 1990; Fairweather 1993). However, there is a difference between spending time on research, focusing on research and being highly productive compared to other peers. Highly productive scholars may also have more formal responsibilities as leaders, deans, department heads, Et cetera. The number of publications co-authored with postdocs or other early-stage researchers may increase for selected scholars with more institutional power, and this power increases with age and seniority (Stephan P. E., 1992).

Based on the information gathered from academic sources, it has become apparent that there is a positive relationship between academic productivity measured by the number of publications of academic articles and the level of salaries. In this sense, there is a lack of research that addresses these study variables in Ecuador. Therefore, the following hypothesis is formulated:

H1: The salaries of university professors have a positive influence on the number of scientific publications.

Methodology

1.6.Data source and variables

This section details how the data of the professor salaries and the number of scientific publications in Scopus were obtained from a sample of eight co-financed universities in Ecuador, which are: Universidad Laica Vicente Rocafuerte, Universidad Politécnica Salesiana, Universidad Católica de Santiago de Guayaquil, Universidad del Azuay, Universidad Tecnológica Equinoccial, Universidad Técnica Particular de Loja, Pontificia Universidad Católica del Ecuador and Universidad Católica de Cuenca during the study period from 2016 to 2020.

The dependent variable corresponds to the number of scientific publications on the Scopus database. Regarding the independent variables, the salaries of graduate teaching assistants, adjunct instructors, professors who work full time, personnel in charge of teaching, supervising, and evaluating practical learning activities or a foreign language, and the personnel in charge of supporting activities in the scientific, technological, arts and humanities research, were taken into account.

1.7.Econometric model

A panel data set, as defined, is a cross-sectional time-series data set that ideally provides repeated measurements of a certain number of variables on observed units over a time frame, such as individuals, households, companies, cities, and states. A cross-sectional data set consists of observations on a number of variables at a given point in time, whereas a time series data set consists of one variable or several variables of observations over several periods. The advantages of using panel data are discussed in detail by Balgati (2001) and Hsiao (1986). This research focuses on several useful points for readers without a deep understanding of econometrics, compared to cross-sectional data analysis.

Another important motivation for panel data analysis is the reduction of the omitted variable bias (Wooldridge, 2006). This is especially true for so-called error component models, which will be

explained further below. For example, by using the fixed-effects model, the unobserved time invariance errors, that are specific to each observation, will be eliminated. As a result, statistically more robust estimation results are obtained.

This section explains the panel data analysis models that are used most frequently in this type of literature. As previously reviewed, the panel data contains information on temporal and spatial dimensions. The time dimension is the period in which repeated measurements are made, such as months, quarters, and years, and the spatial dimension is the unit of observations, such as people, companies, and states. The general panel data regression model can be expressed as follows:

Equation I

$$y_{\text{it}} = \beta_0 + \beta_1 x_{it1} + \beta_2 x_{it2} + \cdots + \beta_k x_{itk} + v_{it} \text{ para i = 1, 2, …, n}$$

where:

i is the unit of observation

t is the period

k indicates the Kth explanatory variable

β_0 is the intersection

β_k is the coefficient of each explanatory variable

v_{it} is the error term.

The so-called compound error term, u_{it}, in equation 1 can be decomposed into two components: a specific error of the cross-section unit, and ai, and an idiosyncratic error, u_{it}.

Equation II

$$v_{it} = a_i + u_{it}$$

The specific error of the cross-sectional unit a_i does not change with time and the idiosyncratic error, u_{it}, varies across cross-sectional units and time (Baltagi, 2001; Greene, 2003; Griffiths et al., 1993; Gujarati, 2003; Maddala, 2001; Wooldridge, 2006). The motivation and benefit of breaking down the error terms into two parts are that if a part of them could be eliminated using panel data, concerns about omitted variable bias caused by unmeasured unit-specific factors would be minimized. By incorporating equation 2 into equation 1, the following equation is obtained:

Equation III

$$y_{\text{it}} = \beta_0 + \beta_1 x_{it1} + \beta_2 x_{it2} + \cdots + \beta_k x_{itk} + a_i + u_{it}$$

Equation 3 is called the error component model. The time constant and the specific error of unit a_i are unobserved factors. Examples include the capacity of the individual when the unit of observation is individuals and the unique culture and institutions of the states in the case of the unit of observation of the states. These factors can be considered invariant in time and, at the same time, it is extremely difficult to measure them. The estimation methods of the error component models are classified

according to how they handle the error term a_i. The grouped OLS model does not distinguish it from other types of errors, whilst the fixed effects model considers them as coefficients to estimate, and the random-effects model treats them as random variables (Baltagi, 2001; Greene, 2003; Maddala, 2001; Wooldridge, 2006).

1.8.Clustered ordinary least squares model (ols)

One of the most basic and simplest methods for estimating Equation 1 is to simply pool the data and apply the OLS. To estimate Equation 1 using pooled OLS, it is necessary to assume that the composite error term v_{it} is not correlated with the explanatory variable x_{itk} (Greene, 2003; Gujarati, 2003; Wooldridge, 2006). This means that only when there are no cross-sectional or temporal effects, data can be pooled, and the OLS regression models can be executed. The combined OLS version of Equation 32.1 can be expressed as follows:

Equation IV

$$y_{\mathrm{it}} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_{itk} + v$$

In equation 4 the subscripts i and t disappear due to the previous assumption. There are some drawbacks to the pooled OLS method. The panel data contains the information for time and cross-sectional dimensions. However, pooled OLS ignores this information from the panel data. Also, the pooled OLS assumption is unrealistic because it is not possible to measure all specific and time constant effects of the a_i unit and include them in the model. Therefore, when OLS is used to analyze panel data, the assumption is usually violated. In this case, the pooled OLS estimator is biased and inconsistent (Gujarati, 2003; Wooldridge, 2006).

1.9.The fixed-effects model

The fixed-effects model is widely used when trying to control omitted variables that are constant over time and vary between units, which is called unobserved heterogeneity or fixed-effects, (a_i) When Equation 3 is estimated using the fixed-effects model, the unobserved heterogeneity (a_i) is assumed to be correlated with the explanatory variable (x_{itj}). Another important assumption is that the idiosyncratic error (v_{it}) is independent of the explanatory variable (x_{itj}) (Baltagi, 2001; Kmenta, 1997; Wooldridge, 2006). By eliminating the unobserved effect ai, which implies reducing the biases of the omitted variables, more robust estimates can be obtained.

1.10. The random-effects model

When analyzing panel data, the fixed effects model is used to eliminate unobserved heterogeneity (a_i) because it is assumed to be correlated with any of the explanatory variables (x_{itj}). However, when ai is independent of each explanatory variable, to eliminate (a_i), the fixed effects model results in inefficient estimators (Baltagi, 2001; Greene, 2003). The random-effects model, also known as the variance components model, considers unobserved heterogeneity (a_i) as random variables rather than

fixed variables (Baltagi, 2001; Greene, 2003; Maddala, 2001). Therefore, the random-effects model is appropriate when cross-sectional units are randomly selected from a large population (Baltagi, 2001).

1.11. Problems in estimating panel data

Knowing which model to use between the fixed-effects and random-effects models is a critical issue. Some econometric textbooks deal with this in-depth (see, for example, Baltagi, 2001). Basically, the debate is about how to deal with unobserved heterogeneity and which model is more efficient. The fixed-effects model assumes that the unobserved heterogeneity (a_i) is correlated with the explanatory variables (x_{itk}), while the random effects model is not. Therefore, the choice between the fixed and random effects models depends on whether or not (a_i) is independent of x_{itk}. However, it is not easy to examine whether (a_i) is correlated with x_{itk} (Baltagi, 2001; Greene, 2003; Kmenta, 1997; Wooldridge, 2006).

Many researchers estimate both the random effects and the fixed effects and then test the statistical significance of differences in the coefficients of the explanatory variables that vary over time (Wooldridge, 2006). The specification test developed by Hausman is generally used to choose one between the fixed and random effects model (Greene, 2003). The Hausman test compares the fixed versus random effects under the null hypothesis that the individual effects (a_i) are independent of the other explanatory variables of the model (Baltagi, 2001; Greene, 2003; Maddala, 2001). If the null hypothesis is not rejected, it is preferred to use random effects because it produces more efficient estimators. On the other hand, if rejected, the fixed effects model is better than the random-effects model. However, the Hausman test is not an absolute standard for selecting between the two models. It is suggested that more attention should be paid to model selection than to statistical testing (Baltagi, 2001).

Based on the above, the following model with panel data is proposed as follows:

Equation V

$$LPUB = \beta_0 + \beta_1 LAUX + \beta_3 LAGRE + \beta_2 LPRIN + \varepsilon$$

Where:

LPUB: Number of articles published in Scopus.

LAUX: Salary of graduate teaching assistants.

LAGRE: Salary of adjunct instructors.

LPRIN: Salary of professors.

ε: Term of error.

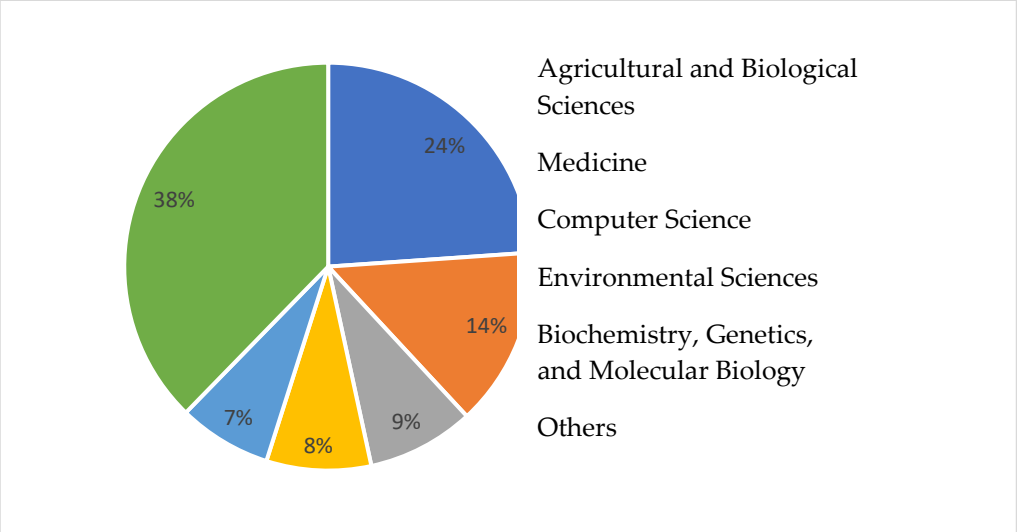
The use of natural logarithms for the variables on both sides of the econometric specification is called a log-log model. This model is useful when the relationship is not linear in the parameters, because the logarithmic transformation generates the desired linearity in the parameters (it should be remembered that linearity in the parameters is one of the OLS assumptions).

Results

Figure 1 shows the percentage of scientific articles published by the departments of the Pontificia Universidad Católica del Ecuador, where 24% of the articles were published by the agricultural and biological sciences schools; 14% of the articles were published by the medicine school; 10% of the articles were published by the computer science school; 8% of the articles were published by the environmental sciences school; 7% of the articles were published by students of the biochemistry, genetics, and molecular biology subjects; and the remaining 38% by other schools.

Figure 1

Percentage of publications from the Pontificia Universidad Católica del Ecuador.

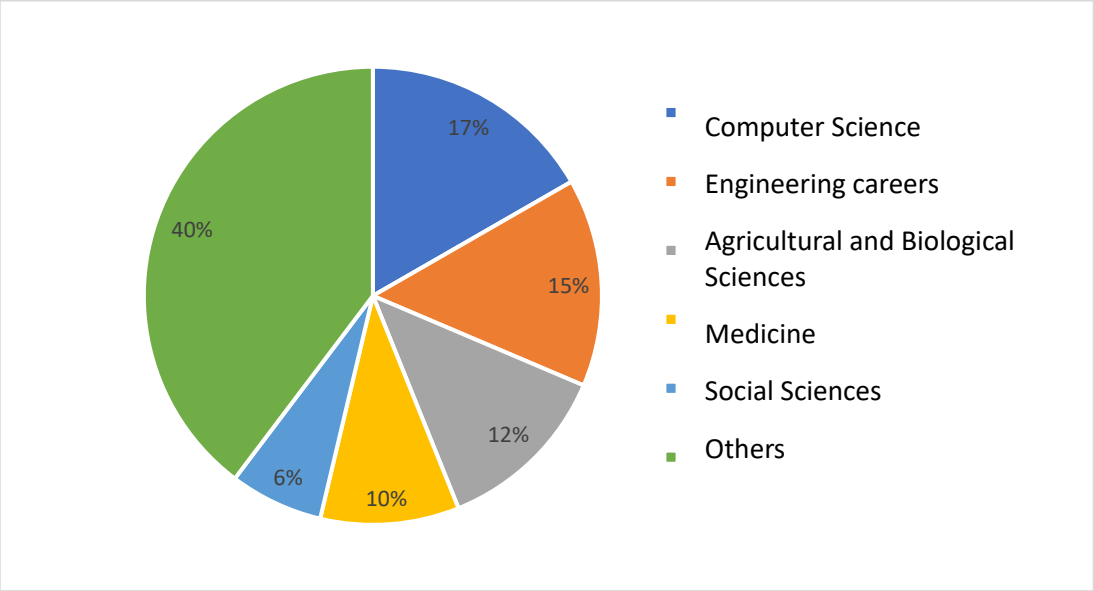


Note. Graph made by the authors of this study.

Figure 2 shows the percentage of scientific articles published by the departments of Universidad del Azuay, where 17% of the articles were published by the computer science school; 15% of the articles were published by the engineering schools; 12% of the articles were published by the agricultural and biological sciences schools; 8% of the articles were published by the environmental sciences school; 10% of the articles were published by the medicine school; 6% of the articles were published by students of the social sciences subject; and the remaining 40% by other schools.

Figure 2

Percentage of publications from Universidad de Azuay.

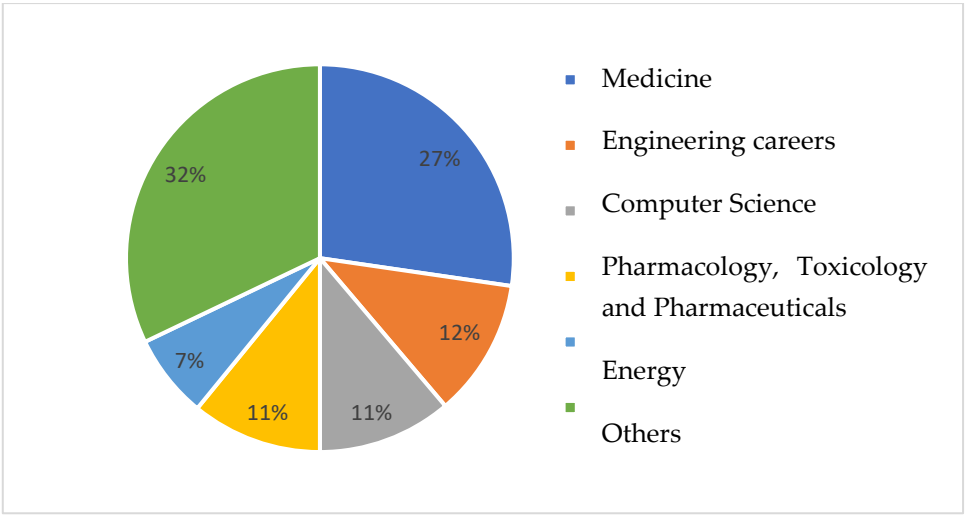


Note. Graph made by the authors of this study.

Figure 3 shows the percentage of scientific articles published by the departments of Universidad Católica de Cuenca, where 27% of the articles were published by the medicine school; 12% of the articles were published by the engineering schools; 11% of the articles were published by the computer science school; 11% of the articles were published by the pharmacology, toxicology and pharmaceuticals schools; 7% of the articles were published by students of the energy subject; and the remaining 32% by other schools.

Figure 3

Percentage of publications from Universidad Católica de Cuenca.



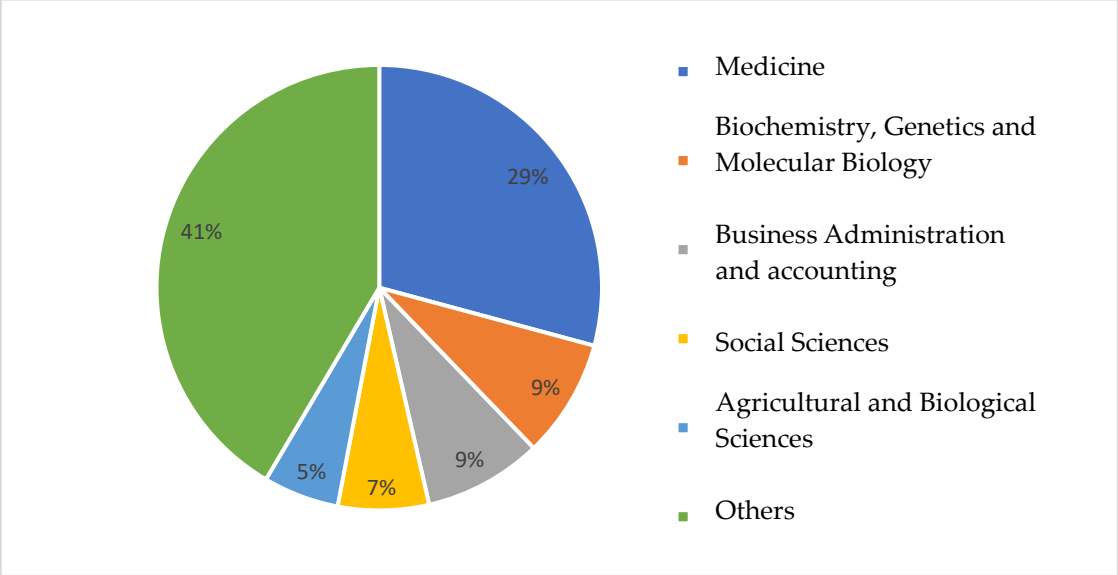
Note. Graph made by the authors of this study.

Figure 4 shows the percentage of scientific articles published by the departments of Universidad Católica de Santiago de Guayaquil, where 29% of the articles were published by the medicine school;

9% of the of the articles were published by the biochemistry genetics and molecular biology schools; 9% of the articles in scientific magazines were published by the business administration and accounting schools; 7% of the articles were published by the social sciences schools; 5% of the articles were published by students of the agricultural and biological sciences subjects; and the remaining 41% by other schools.

Figure 4

Percentage of publications from Universidad Católica Santiago de Guayaquil.

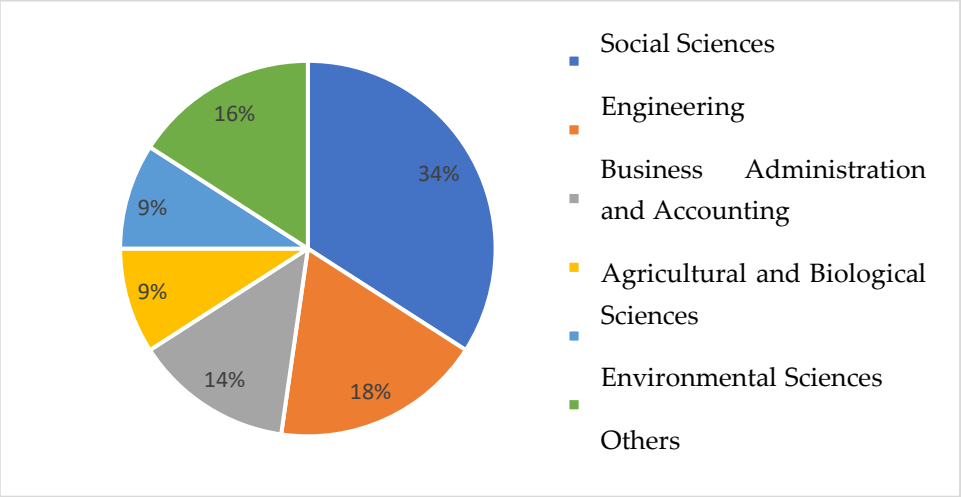


Note. Graph made by the authors of this study.

Figure 5 shows the percentage of scientific articles published by the departments of Universidad Laica Vicente Rocafuerte, where 34% of the articles were published by the social sciences schools; 18% of the of the articles were published by the engineering schools; 14% of the articles were published by the business administration and accounting schools; 9% of the articles were published by the agricultural and biological sciences school; 9% of the articles were published by students of the environmental subject; and the remaining 16% by other schools.

Figure 5

Percentage of publications from Universidad Laica Vicente Rocafuerte.

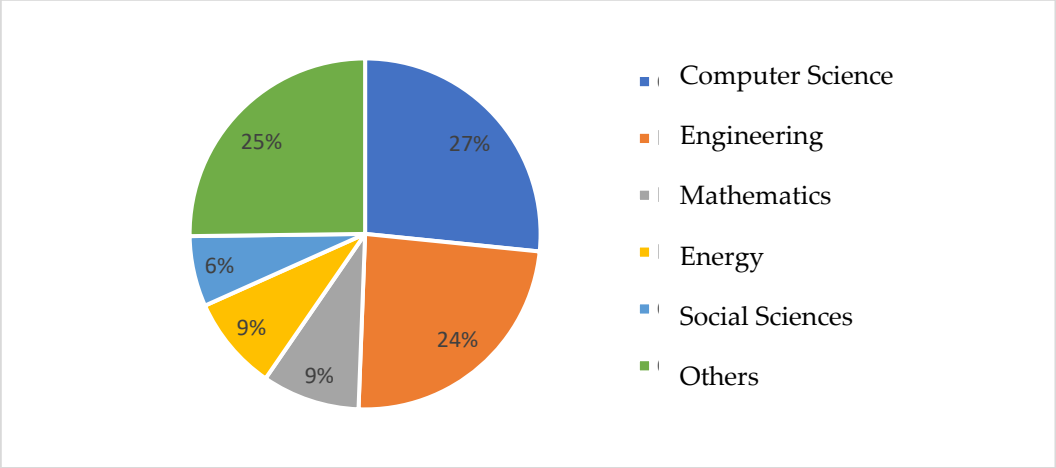


Note. Graph made by the authors of this study.

Figure 6 shows the percentage of scientific articles published by the departments of Universidad Politécnica Salesiana, where 27% of the articles were published by the computer science school; 24% of the of the articles were published by the engineering schools; 9% of the articles were published by the mathematics school; 9% of the articles were published by students of the energy subject; 9% of the articles were published by the social sciences subject; and the remaining 25% by other schools.

Figure 6

Percentage of publications from Universidad Politécnica Salesiana.

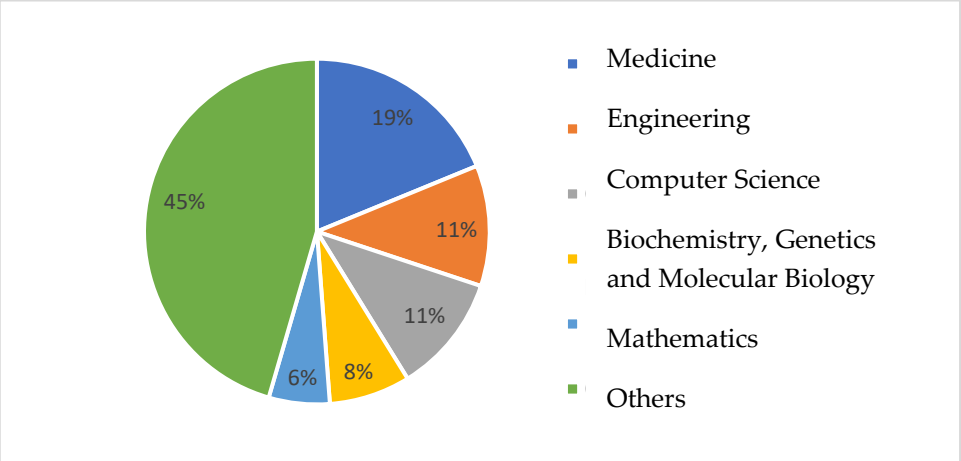


Note. Graph made by the authors of this study.

Figure 7 shows the percentage of scientific articles published by the departments of Universidad Tecnológica Equinoccial, where 19% of the articles were published by the medicine school; 11% of the of the articles were published by the engineering schools; 11% of the articles were published by the computer science school; 8% of the articles were published by the biochemistry, genetics and molecular biology schools; 6% of the articles were published by the mathematics subject; and the remaining 45% by other schools.

Figure 7

Percentage of publications from Universidad Tecnológica Equinoccial.

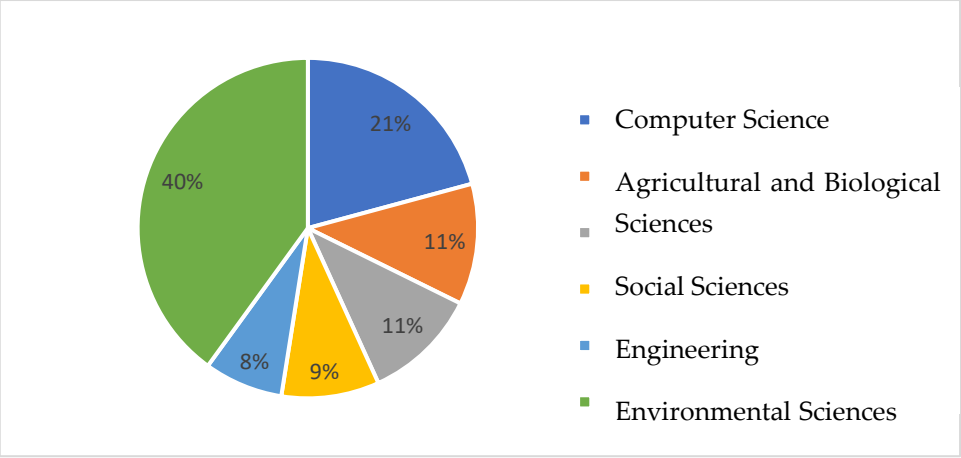


Note. Graph made by the authors of this study.

Figure 8 shows the percentage of scientific articles published by the departments of Universidad Técnica Particular de Loja, where 21% of the articles were published by the computer science school; 11% of the of the articles were published by the agricultural and biological sciences school; 11% of the articles were published by the social sciences school; 9% of the articles were published by the engineering schools; 8% of the articles were published by the environmental sciences subject; and the remaining 40% by other schools.

Figure 8

Percentage of publications from Universidad Técnica Particular de Loja.

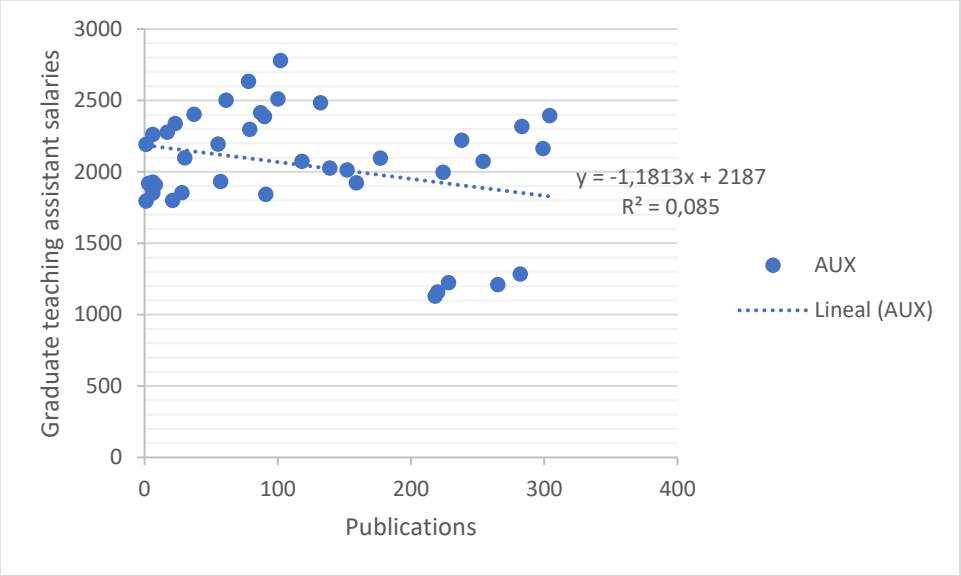


Note. Graph made by the authors of this study.

The following graph shows the dispersion between the number of publications and the salaries of graduate teaching assistants. The graph suggests that there is a negative relationship between both study variables, so that an increase in the salary of graduate teaching assistants leads to a decrease in the number of publications in Scopus (figure 9).

Figure 9

Dispersion chart between the number of publications and the salaries of graduate teaching assistants.

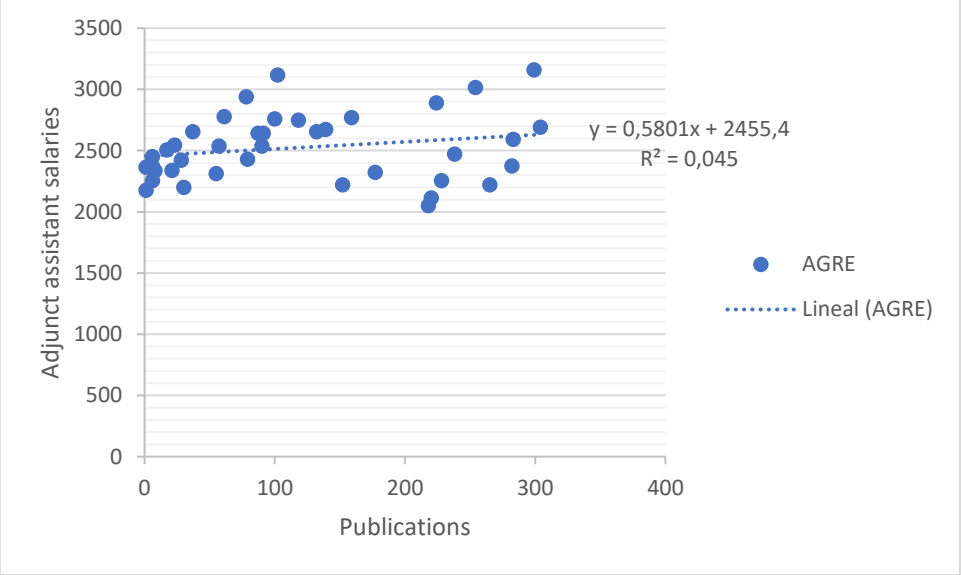


Note. Graph made by the authors of this study.

The following graph shows the dispersion between the number of publications and the salaries of the adjunct instructors. The graph suggests that there is a positive relationship between both study variables, so that an increase in the salary of adjunct instructors leads to an increase in the number of publications in Scopus (figure 10).

Figure 10

Dispersion chart between the number of publications and the salaries of adjunct instructors.

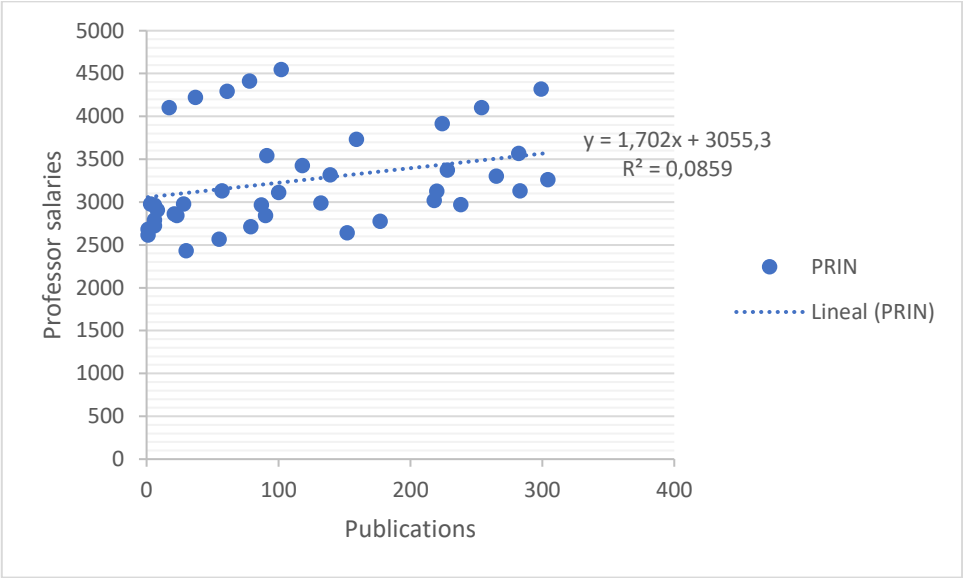


Note. Graph made by the authors of this study.

The following graph shows the dispersion between the number of publications and the salaries of professors. The graph suggests that there is a positive relationship between both study variables, so that an increase in the salary of professors leads to an increase in the number of publications in Scopus (figure 11).

Figure 11

Dispersion chart between the number of publications and the salaries of professors.



Note. Graph made by the authors of this study.

The results of the econometric models that evaluate the individual effects of the salaries of the different academic career levels and the number of publications suggest that the universities where graduate teaching assistants contributed to the highest growth in their publications are Universidad Tecnológica Equinoccial and Universidad del Azuay, with coefficients of 79.44% and 79.08% respectively. At the group level, it is observed that for every 1% increase in the salaries of graduate teaching assistants increase, the publications of the articles increase by 10.6%, being statistically significant.

Regarding the adjunct instructors, the results suggest that the universities where the adjunct instructors that contributed with the highest growth in publications are Universidad Laica Vicente Rocafuerte and Universidad Tecnológica Equinoccial, with coefficients of 72.01% and 71.53% respectively. At the group level, it is observed that for every 1% increase in the salaries of adjunct instructors, the publication of articles increases by 9.47%, being statistically significant.

Finally, regarding professors, the results suggest that the universities where they contributed with the highest growth in their publications are Universidad del Azuay and Universidad Laica Vicente Rocafuerte, with coefficients of 72.93% and 71.72% respectively. At the group level, it is observed that for every 1% increase in the professor salaries, the publications of the articles increase by 9.18%, being statistically significant.

Table 1

Results of econometric models

Universities	Graduate teaching assistants	Adjunct instructors	Professors
Grouped model	10.60***	9.47***	9.18***
Pontificia Universidad Católica del Ecuador	75.31***	70.27***	70.70***
Universidad del Azuay	79.08***	71.28***	72.93***
Universidad Católica de Cuenca	76.19***	70.27***	69.88***
Universidad Católica Santiago de Guayaquil	77.77***	69.61***	68.31***
Universidad Laica Vicente Rocafuerte	78.56***	72.01***	71.72***
Universidad Politécnica Salesiana	76.19***	68.56***	67.93***
Universidad Tecnológica Equinoccial	79.44***	71.53***	70.22***
Universidad Técnica Particular de Loja	69.67***	67.45***	68.82***

Note: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

To validate the proposed models, the diagnostic tests shown in table 2 were performed. The results showed that both models presented autocorrelation and heteroscedasticity problems. In this sense, to mitigate these problems, the Newey West and White tests were used to correct these problems. As a matter of fact, both econometric models meet the regression assumptions.

Table 2

Diagnostic tests

Diagnostic Tests	Model 1	Model 2	Model 3
Breusch-Godfrey (Autocorrelation)	0.001534	0.00164	0.001189
Durbin-Watson (Autocorrelation)	1.554e-06	1.839e-06	7.482e-07
Breusch-Pagan (Heteroscedasticity)	0.02107	0.02098	0.02561

NCV Test (Heteroscedasticity)	0.00040746	0.00040896	0.0013803

Note: * Presence of heteroscedasticity

Once the individual effects of the variables were studied, the pooled effects were estimated using the panel data. Table 3 shows the coefficients of the variables estimated through the OLS models, the pooled model, the fixed and random effects. The results suggest that for the OLS models and the pooled model, the salaries of graduate teaching assistants and adjunct instructors are significant. Additionally, the random effects regression estimated that the salary of adjunct instructors is significant. Finally, the fixed effects model shows that no variable is significant.

Table 3

Panel data model

Wages	OLS	Regression of the grouped model	Fixed Effects Regression	Random Effects Regression
Constant	-47.670**	-47.6704**		65.5353***
LAUX	-4.493**	-4.493**	-18.7099	-4.5015
LAGRE	12.011*	12.011*	24.1883	13.1253*
LPRIN	-1.007	-1.007	1.9898	0.97523

Note: *, **, *** are the significance levels of 10%, 5% and 1% respectively.

Regarding the selection of the best model, the following diagnostic tests were used: the Lagrange FF multiple tests, the individual F test or effects over time, and the Hausman test for panel models. In this sense, the Lagrange test suggests using the fixed effects on the OLS model, while the F test maintains that the random effects should be used on the pooled model. Finally, the Hausman test shows a p-value of 0.9364, therefore, the null hypothesis of choosing the fixed effects is rejected, and it is concluded that the random effects should be used.

Table 4

Model selection tests

Test	p-Value
Lagrange FF Multiplier Tests for Panel Models	6.639e-12
F Test for Individual and/or Time Effects	3.011e-09
Hausman Test for Panel Models	0.9364

Coefficients can be interpreted from the selected model: the 1% increase in graduate teaching assistant salaries leads to a 4.5% reduction in the number of scientific articles published in Scopus, while the 1% increase in adjunct instructor salaries leads to a -13.12% increase in scientific publications. Finally, the 1% increase in professor salaries implies the growth of publications of

scientific articles by 0.97%. However, both variables, adjunct instructor salaries and professor salaries, are not statistically significant.

Discussion

To test hypothesis 1, which establishes that the salaries of teachers in co-financed universities are positively related to the number of publications of scientific articles, it was necessary to apply the panel data model in order to measure these effects. The results suggest that the salaries of graduate teaching assistants are negatively related to the number of publications, which is not statistically significant. On the other hand, the salaries of adjunct instructors and professors are positively related to the number of publications, being the variable graduate teaching assistant salaries statistically significant.

This research project has implications for current and assumed theoretical models in salary studies. The findings tend to suggest that the traditionally explored link between higher scientific productivity and higher academic earnings has been consistently demonstrated in subsequent investigations over the past four decades (as in Katz (1973); Konrad and Pfeffer (1990); Fairweather (1993); Gomez-Mejia and Balkin (1992); Fairweather (2005); Melguizo and Strober (2007); and Gibson et al. (2014)).

Academic salaries and the distribution of research / non-research time are at the core of the traditional university enterprise. The questions about what to do (proportions of teaching, research and administration time and whether to carry out basic or applied research) and where to be (which institution, academia or industry, and possibly in which national system) are looming not only for the academic individuals but also at the institutional and national level, guiding the institutional reform agendas (Pinheiro et al. 2012; Stensaker et al. 2012) and national (Enders et al. 2011; Musselin and Teixeira 2014).

Conclusions

The objective of the research is to determine the influence of the professor salaries of the co-financed universities of Ecuador in the number of publications of scientific articles. This objective is relevant for the present work because in the academic field it is important to know the relationship between the income of professors and their level of academic productivity.

Based on the above, it was observed that the areas where scientific articles are predominantly published are: medicine, computer science, agricultural science, and engineering. The results suggest that the co-financed universities prioritize hard sciences publications on the Scopus portal.

The results of the econometric models that evaluate the individual effects of the salaries of the different academic career levels and the number of publications suggest that the universities where adjunct assistants contributed with the highest growth in publications are Universidad Tecnológica Equinoccial and Universidad del Azuay, with coefficients of 79.44% and 79.08% respectively. Regarding the adjunct assistants, the universities where they made greater contributions are the Vicente

Rocafuerte Lay University and the Equinoctial Technological University, with coefficients of 72.01% and 71.53% respectively. Finally, regarding professors, the results suggest that the universities where they contributed with the highest growth in publications are Universidad del Azuay and Universidad Laica Vicente Rocafuerte, with coefficients of 72.93% and 71.72% respectively.

On the other hand, the results of the analysis of the grouped effects of the co-financed universities were measured through panel data with random effects, where the 1% increase in the variable graduate teaching assistant salaries entails a decrease in the publications of scientific articles by -4.50%. On the other hand, with respect to the variable adjunct instructor salaries, the 1% increase of the same leads to a 13.12% increase in the publications of scientific articles. Finally, with respect to the variable professor salaries, the 1% increase of the same implies an average growth rate of 0.98% of the publications of scientific articles. However, only the variable adjunct assistant salaries prove to be statistically significant.

Limitations of the study

Among the limitations of the study, it is worth mentioning that there is no database with the characteristics of the teaching staff such as gender, age, work experience, average hours of teaching per month, proportion of presence in administrative meetings, among other contributing factors such as variables explaining scientific productivity.

Future lines of research

Research should be conducted on the determinants of the individual scientific performance of the teaching staff of the co-financed universities to find an answer to what characteristics professors must have to influence greater productivity.

General discussion

La presente investigación, titulada "Análisis del Impacto de la Inversión, los Ingresos y los Salarios en las Universidades Cofinanciadas de Ecuador," ofrece una visión integral de cómo estos factores influyen en la calidad educativa y la producción científica de dichas instituciones. La relación entre el aumento de ingresos y gastos en las universidades es clara: a medida que aumenta la matrícula estudiantil, los ingresos generados por tarifas y otros conceptos también se incrementan. Sin embargo, la gestión de estos ingresos puede variar considerablemente entre universidades, con algunas enfocándose en mejorar la infraestructura, mientras otras priorizan la tecnología educativa o los servicios estudiantiles.

El crecimiento de la matrícula implica la necesidad de contratar más personal académico y administrativo, así como la expansión de infraestructuras educativas y la inversión en tecnología y servicios de apoyo. Estos gastos son esenciales para mantener la calidad educativa y la competitividad. El análisis sugiere que los gastos en salarios de los profesores tienen un impacto positivo en los ingresos de las universidades cofinanciadas, mientras que los salarios del personal administrativo muestran un impacto negativo, aunque estas relaciones no son estadísticamente significativas. Además, la relación entre los salarios de los profesores y la producción científica es positiva, lo que respalda la idea de que una mayor productividad científica está asociada con mayores ingresos académicos.

El artículo 1 destaca cómo el aumento de los ingresos se traduce en un aumento de los gastos necesarios para acomodar a una creciente población estudiantil, incluyendo la contratación de personal adicional y la mejora de infraestructuras. El artículo 2 examina el impacto de los salarios en los ingresos de las universidades, encontrando que los salarios de los profesores contribuyen positivamente a los ingresos, mientras que los salarios administrativos tienen un efecto negativo. El artículo 3, por su parte, analiza la relación entre los salarios y la productividad científica, encontrando una correlación positiva entre los salarios de los profesores y el número de publicaciones científicas.

La inversión, los ingresos y los salarios son elementos cruciales para el desarrollo y la calidad de las universidades cofinanciadas en Ecuador. La gestión eficiente de estos recursos es fundamental para garantizar una experiencia educativa de alta calidad y fomentar la investigación y el desarrollo académico, contribuyendo así al crecimiento y la competitividad de estas instituciones en el ámbito nacional e internacional.

Conclusions

Conclusions

En conclusión, el primer capítulo demuestra que existe una relación positiva entre los ingresos por matrículas, pensiones y otros rubros, y los gastos en infraestructura, tecnología e investigación en las universidades UPS, UCSG y ULVR. Aunque las variables no resultaron estadísticamente significativas, los datos sugieren que el aumento de ingresos permite a las universidades invertir en mejoras que benefician la calidad educativa y la capacidad de atender a un mayor número de estudiantes. Estos hallazgos subrayan la importancia de considerar estas relaciones al desarrollar políticas de financiamiento y regulación para promover una educación superior equitativa y de calidad en Ecuador. Además, es crucial que las universidades gestionen eficientemente sus recursos financieros para mejorar la infraestructura y la calidad de la enseñanza, adaptándose a las crecientes demandas de la población estudiantil.

El segundo capítulo se centra en el efecto del gasto en salarios del personal académico y administrativo sobre los ingresos de las universidades cofinanciadas en Ecuador durante el periodo 2017-2020. Los resultados del modelo de datos panel con efectos aleatorios indican que un aumento del 1% en los salarios de los profesores está asociado con un incremento del 0.49% en los ingresos universitarios, mientras que un aumento del 1% en los salarios administrativos está asociado con una reducción del 0.08% en los ingresos. Sin embargo, ambas variables no son estadísticamente significativas. Estos resultados sugieren que aunque los incrementos salariales pueden tener diferentes impactos en los ingresos, es crucial considerar otros factores al evaluar la efectividad de las políticas salariales en las universidades. Se requiere más investigación para comprender mejor esta relación y diseñar estrategias que optimicen el uso de recursos para beneficiar tanto a la academia como a la administración.

El tercer capítulo analiza la influencia de los salarios de los profesores en la cantidad de publicaciones científicas en las universidades cofinanciadas de Ecuador. Los hallazgos muestran que los salarios de los profesores están positivamente relacionados con la producción científica, especialmente en áreas como medicina, informática, ciencias agrícolas e ingeniería. Los modelos econométricos indican que un aumento del 1% en los salarios de los profesores implica un crecimiento del 0.98% en el número de publicaciones, aunque solo los salarios de los asistentes de enseñanza graduados resultaron estadísticamente significativos. Este estudio resalta la importancia de los salarios competitivos para fomentar la productividad académica y el desarrollo científico en las universidades, subrayando la necesidad de políticas que apoyen tanto la investigación como la docencia para mejorar la calidad educativa y la innovación. Las universidades co-financiadas deben priorizar la inversión en recursos humanos cualificados para consolidar su posición en la producción de conocimiento y contribuir al progreso científico y tecnológico del país.

Recommendations

Recommendations

Se recomienda que las universidades cofinanciadas en Ecuador y los responsables de la formulación de políticas consideren la relación positiva entre los ingresos por matrículas y otros rubros y la inversión en infraestructura, tecnología e investigación. Es fundamental desarrollar políticas de financiamiento que incentiven el aumento de ingresos a través de la optimización de la matrícula y otras fuentes, permitiendo así mejoras continuas en la infraestructura y en la calidad educativa. Además, se debe fomentar una gestión financiera eficiente que priorice las inversiones estratégicas en áreas críticas para el desarrollo institucional y la satisfacción de las crecientes demandas estudiantiles.

Para mejorar el impacto de los salarios en los ingresos universitarios, es crucial que las políticas salariales se diseñen con un enfoque equilibrado, considerando tanto el bienestar del personal académico como el administrativo. Se sugiere realizar investigaciones adicionales para comprender mejor la relación entre los salarios y los ingresos universitarios, y desarrollar estrategias que maximicen los beneficios económicos de los incrementos salariales. Las universidades deben valorar y remunerar adecuadamente a su personal académico, no solo como una medida de justicia social, sino también como una inversión estratégica que promueva la calidad educativa y la retención de talento. Asimismo, es importante evaluar el rendimiento del personal administrativo y su impacto en la eficiencia institucional, implementando mecanismos de incentivos que fomenten su productividad y compromiso.

Finalmente, para fortalecer la producción científica, se recomienda que las universidades cofinanciadas prioricen la inversión en salarios competitivos para los profesores y fomenten un entorno que promueva la investigación y la innovación. Se deben implementar políticas que faciliten el equilibrio entre las actividades de docencia e investigación, proporcionando los recursos necesarios y el apoyo institucional para que los académicos puedan alcanzar su máximo potencial. Además, es esencial investigar los determinantes del rendimiento científico individual de los profesores para identificar las características que influyen en una mayor productividad. Estas estrategias contribuirán a elevar la calidad de la investigación, posicionando a las universidades ecuatorianas como líderes en la producción de conocimiento y desarrollo tecnológico, y beneficiando así al progreso general del país.

Limitations

Limitations

Basado en las conclusiones y recomendaciones derivadas de los artículos analizados, es importante reconocer varias limitaciones significativas en los estudios realizados. Primero, respecto al análisis de la relación entre ingresos universitarios y gastos, las variables estudiadas, aunque revelaron tendencias positivas, no alcanzaron significancia estadística en varios casos. Esta limitación sugiere la necesidad de contar con muestras más amplias y datos más detallados que permitan una evaluación más precisa de cómo los ingresos específicos, como las matrículas y otros rubros, impactan realmente en la inversión y mejora institucional.

En segundo lugar, el estudio sobre el impacto de los salarios del personal académico y administrativo en los ingresos de las universidades enfrenta la falta de estudios previos que utilicen modelos econométricos para este propósito específico. Esta carencia en la literatura limita la comparación y validación de los resultados obtenidos, dificultando la generalización de las conclusiones. Además, la ausencia de datos detallados sobre características específicas del personal, como experiencia laboral, género, y horas dedicadas a la docencia y actividades administrativas, también afecta la robustez de los hallazgos y la capacidad para realizar análisis más profundos.

Finalmente, en el estudio sobre la influencia de los salarios de los profesores en la producción científica, una limitación destacable es la falta de una base de datos que recoja estas características detalladas del personal docente. Esta ausencia impide una comprensión más completa de los factores que impulsan la productividad científica, como la edad, el género y la participación en actividades administrativas, entre otros. La falta de estas variables explicativas podría subestimar o limitar las conclusiones sobre la verdadera influencia de los salarios en la producción académica y científica de las universidades cofinanciadas en Ecuador.

En resumen, aunque los estudios proporcionan importantes perspectivas sobre la relación entre ingresos, salarios y calidad educativa en las universidades ecuatorianas, estas limitaciones subrayan la necesidad de futuras investigaciones que aborden estas deficiencias metodológicas y de datos para mejorar la validez y aplicabilidad de los resultados en el contexto educativo y académico del país.

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