"Climatic Shocks and Human Mobility: Exploring the Effect of Rainfall on Internal Migration Patterns in Peru"

A Research Paper

by:

Rafael Rodríguez Gómez

MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

Economics of Development – ECD

Supervisor:
Arjun Bedi

Second Reader:
John Cruzatti

The Hague, The Netherlands
November 2023

Inquiries:

International Institute of Social Studies
P.O. Box 29776
2502 LT The Hague
The Netherlands

t:	+31 70 426 0460
e:	info@iss.nl
w:	www.iss.nl
fb:	http://www.facebook.com/iss.nl
twitter:	@issnl

Location:

Kortenaerkade 12
2518 AX The Hague
The Netherlands

Contents

List of Tables

List of Figures

Abstract

The present research studies the relationship between rainfall occurring during the rainy season (December to March) and internal migration patterns in Peru for the period 2007-2010. Specifically, it considers inter-province and intra-province migration indicators, and the rural population rate as a "proxy" for rural-to-urban migration. It employs a province-level panel data set built from the National Household Survey (ENAHO) conducted by the Statistics Bureau of Peru and georeferenced climate data from the Climatic Research Unit of the University of East Anglia (CRU TS 4.07).

The findings indicate a significant quadratic negative relationship between the inter-province immigration rate and precipitation, demonstrating an inverted "U" shape with a critical threshold at 1,070 millimeters. Beyond this point, the immigration rate starts to decline. Furthermore, the study explores the influence of unexpected precipitation shocks, revealing that both negative (less or equal than -0.75 standard deviations) and positive (greater or equal than 0.75 standard deviations) shocks significantly affect the immigration rate and the rural population rate. These critical points appear as pivotal thresholds, beyond which the effects become perceptible. In assessing precipitation-related disasters -specifically landslides, floods, and farmland loss/damage- the study shows no statistically significant relationship for the overall sample.

However, when examining geographical variations, coastal provinces exhibit a positive relationship between the emigration rate and rainfall, when the threshold of 504-615 millimeters is surpassed. Conversely, the Amazon experiences a 3-percentage point increase in the immigration rate for every 10-percentage point increase in rurality. Additionally, emigration increases by 1 percentage point for each 1,000-hectares loss/damage of cropland.

This research provides valuable insights into the role of precipitation in shaping internal migration patterns in Peru, emphasizing the need for nuanced regional analysis to fully comprehend the diverse effects considering the geographic particularities within the country.

Keywords

Internal Migration, Rainfall variability, Natural disasters, Peru.

Relevance to Development Studies, Motivation, and Research Gap[1]:

The present study is of utmost relevance as it is framed within the empirical evidence about the negative impacts of climate change. These effects are expected to become increasingly severe over time, as the incidence of climatic shocks will occur more frequently. Peru is a country that presents high levels of vulnerability to climate change, and in this sense, it is crucial to explore its potential effects in different spheres of social life. The existing literature has focused on understanding its macroeconomic impacts, mainly on national and sectorial productivity. This study seeks to transcend this perspective by exploring its impact on internal migration patterns. There is extensive international evidence that assesses the interrelation between climate change-related events and internal mobility dynamics. However, this evidence is still incipient in Peru. Migration also has significant implications for the localities of origin and destination: the loss (gain) of human capital, the pressure for land, the increased demand for public services, the increase of local labor supply, among others. This way, it becomes essential not only to discover whether climate variations affect internal mobility processes, but also to comprehend what these patterns are, to formulate risk mitigation and adaptation strategies for future contingencies.

[1] I am thankful to all the people who directly or indirectly supported me during the preparation of this research. I especially want to thank Professor Arjun Bedi, for his constant and valuable feedback, and for guiding me through this path. To Professor John Cruzatti for his suggestions and comments. To Vanessa Ramírez, for contributing with new ideas and helping me make sense of the main findings. To Alfredo Bernal, for helping me understand the results considering the social and structural processes that frame them. To my ECD colleagues and friends, from whom I learned so much over these months. Finally, to my family, for their support and love, and to all my closest friends.

I. Introduction: Problem Statement, Research Question, and Relevance:

Since the 20th century, Latin American countries have experienced notable changes in their demographic composition. These transformations were primarily driven by urbanization processes, international and internal migration, and improvements in public services, which impacted the reduction of mortality rates. During this period, many of the region's countries adopted domestic-oriented economic growth policies and inward-looking industrialization processes, which reshaped the composition of their urban and rural territories (Lattes, 1995). Today, nearly 80 percent of Latin America's population live in cities, and new migration patterns have emerged in the past years. The importance of rural-to-urban migration has decreased in favor of intra-cities mobility, and mega-cities are no longer the leading destinations for migrants. Instead, mid-cities have gained more relevance as "pulling" localities for individuals and families (IDB, 2015). In many cases, the cities that experienced population growth showed important increases in economic activity, especially mid-cities[2], which, on average, contribute to 30% of the region's GDP (McKinsey Global Institute, 2011).

In the case of Peru, the population's redistribution within the territory has positively influenced migrants' living conditions. Many localities boosted their local economies and benefitted from internal migration, which brought improvements in human capital and made possible a more efficient exploitation of resources in these areas. In this sense, the development of new economic activities across the territory, such as commerce, industry, and services, determined the configuration of urban centers and cities, where internal migration had a crucial role in these processes (Sánchez, 2015). According to the last census conducted by the Statistics Bureau of Peru (INEI) in 2017, around 79 percent of the population live in the same region where they were born, whereas 20 percent live in a region other than their birthplace; in other words, they migrated within the national territory and across regional borders[3]. Likewise, nearly 5 percent of the national population migrated from one region to another between 2012 and 2017. The country's capital city, Lima, remains the primary destination for internal migrants in Peru, where around 50 percent of its inhabitants indicated they were born in other regions (INEI, 2017).

The current migration patterns in the country reflects the dynamics of internal migration processes which emerged in the middle of the last century. Data from the census conducted in 1940 shows that almost 9 percent of the population migrated to other areas within the territory, and in 1961 this proportion increased to 15 percent. During the decade of the 1970s, internal migration was mainly determined by an agricultural crisis that succeeded after the military government in power carried out a land reform in the late 1960s. Throughout the 1980s and 1990s, Peru went through a violent political conflict between the Peruvian State and the Shining Path (Sendero Luminoso), an armed group influenced by Maoism aimed at seizing power and overthrowing the government through violent means. During

[2] The concept of mid-city does not have a single agreed-upon definition that transcends its demographic or quantitative notion. However, in a broad sense, a mid-city has the capacity to connect the urban system since it plays an "intermediary" role between the urban-rural relations based on its economic structure and social relations (Llop et al., 2019; Vega Centeno and Vilela, 2019). In Peru, the official demographic definition comes from the Statistics Bureau (INEI), in which a mid-city is considered as having between 50 thousand and 100 thousand inhabitants. Various local studies have taken this definition as a reference: Vásquez, 2019; Ponce, 2010.

[3] Peru officially has three administrative units: The largest is the region/department, followed by the province, and finally, the district. The Peruvian territory has 24 regions/departments, 196 provinces, and 1,874 districts.

this period, both parties were responsible for nearly 69 thousand deaths, and almost three out of four victims were peasants and people who resided in rural localities who did not have Spanish as their mother tongue[4]. The epicenter of the internal armed conflict was mainly in the highlands and localities of the Peruvian Andes, historically considered poor and marginalized. In this sense, internal displacement and migration were predominantly determined by the consequences of this period of political upheavals. By the end of the 20th century, the migration patterns were essentially from the highlands to the coastal regions and rural-to-urban mobility (Sánchez, 2015).

Currently, internal migration is predominantly motivated by economic factors, such as regional disparities in wages and income, commonly known among the migration theories and literature as "labor migration." Moreover, the existing literature on internal migration in Peru focuses on its understanding from a purely demographic and socioeconomic perspective. However, climate change may also play a crucial role in internal mobility dynamics, which has not been deeply studied and documented within the literature on internal migration and displacement in Peru. Historically, Peru has been characterized by extreme weather and climate fluctuations. Still, these variabilities may have been exacerbated in the context of anthropogenic climate change, creating new challenges for the populations living within the Peruvian territory and for the national authorities, where new adaptation policies must be adopted to minimize climate change impacts. Climatic shocks pose an important threat to the forms of land use, water availability, food production, public health, and livelihoods across the world's population. This way, although non-climatic related factors are still dominant in explaining internal migration, climatic determinants are becoming more influential in migration decisions. They will become more prominent as climate change impacts become more significant (Bergmann et al., 2021).

In this sense, this research aims to understand and identify the different internal migration patterns that have risen in the past years, especially those related to changes in precipitation, proxy for climate change. In other words, this study investigates the effect of rainfall occurring during the rain season -which takes place between December and March- on internal mobility dynamics. It focuses particularly on the period between 2007 and 2010, where a panel data set at the province level was built to assess changes in migration patterns, mainly in inter-province and intra-province migration separately, and changes in rural population within these localities. Likewise, the inter-province migration indicator is decomposed into immigration, emigration, and migration balance values to assess which factor dominates and is comparatively more affected by changes in precipitation. This way, the underlying research question is the following: To what extent rainfall that occurred during the rainy season between 2007 and 2010 affected the diverse internal migration patterns in Peru?

It is important to highlight that this period was considered in the analysis due to three fundamental reasons. Firstly, because during these years there were no large-magnitude climatic events especially those related to El Niño and La Niña. Secondly, because in this period there were no extreme variations in precipitation. Between 2007 and 2009, precipitation deviated nearly to 0.75 standard deviations from the historical mean at the country level. In 2010, a larger variation was observed, which was nearly -1.7 standard deviations. However, compared to other years, this deviation is not significantly large in

[4] Final Report of the Truth and Reconciliation Commission (CVR) 2003. Volume I. Preface.

magnitude. And, thirdly, because during this period there were no elections of political authorities and representatives at the highest government level, so the influence of these determinants on internal migration dynamics is also controlled. On the other hand, regarding the migration indicators, it is important to clarify that these are annual values. In this sense, it is expected that the effect of precipitation during the rainy season are not immediate but may also occur with certain delays and in later months.

Regarding the relevance, the importance of this study lies in the fact that migration can be understood as an adaptation strategy (Waldinger, 2015). On the one hand, migration decisions can mean more and better opportunities for migrants since they can move to places that would allow them to improve their productive capacities. However, migration processes also carry out some crucial risks. For instance, people may migrate to areas where the labor force is not efficiently allocated, such as localities with high unemployment or informality. Also, internal migration has crucial consequences both in the localities of origin and in the receiving areas. In this way, the economic impacts of internal migration can be positive if migrants move to areas with higher returns to labor. Hence, localities of origin may benefit from remittances, boosting consumption and investment in these areas. Likewise, receiving localities can benefit from internal migration processes if migrants meet the necessary conditions to improve their productivity, which also dynamizes consumption in the receiving regions. For instance, De Brauw and Harigaya (2007) find that internal migration increased annual expenditure by 5.2 percentage points in Vietnam. However, the effects of internal mobility can also be adverse, as in the case where origin localities lose their high-skilled workers and human capital.

On the other hand, migration has relevant public policy implications. In principle because there are different adaptation strategies other than internal migration. Mobility processes can be highly costly, so people may be constrained to develop local adaptation strategies instead of migrating to other areas. In the case of Peru, migration patterns in the past years have been predominantly from rural to urban regions. In this sense, policies that incentivize agricultural productivity in rural localities, such as alleviating credit constraints, can critically affect migration decisions.

The main findings in this study show that precipitation occurring during the rainy season has a negative quadratic relationship with the inter-province immigration rate. Graphically, this relationship has the shape of an inverted "U". Thus, the immigration rate increases with rainfall up to the 1,070-millimeters threshold. After this point is reached, the immigration rate decreases. On the other hand, when assessing the unexpected nature of precipitation, measured as the magnitude of the deviation of rainfall with respect to its historical mean, it is observed that negative shocks -less or equal to -0.75 standard deviations- and positive shocks -greater or equal than 0.75 s.d.- have effects on the immigration rate and the rural population rate. After evaluating the 0.5 (-0.5) and 0.6 (-0.6) cut-off points, the effect on the internal migration patterns is null. This way, it is inferred that the values of 0.75 and -0.75 are critical points above which the effects begin to be perceived. By differentiating positive from negative shocks, the immigration rate increases by 3 percentage points in provinces that experienced negative rainfall shocks compared to provinces where no shocks occurred. Finally, after exploring the effect of precipitation-related disasters -specifically landslides, floods, and loss/damage of farmland- on internal migration patterns, no statistically significant relationship was found for the full sample.

However, when assessing geographical heterogeneities, it is shown that the effects of precipitation and rainfall shocks are different between the coast and the Amazon. In the case of the coastal provinces, rainfall has a positive relationship with the emigration rate after exceeding the critical point of 504-614 millimeters. Likewise, emigration decreases by 1.5 percentage points in the occurrence of a landslide. In contrast, the immigration rate increases by 3 percentage points when the rurality increases by 10 percentage points in the Amazon. Similarly, emigration increases by 1 percentage point for each 1,000-hectares loss/damage of cropland on average. It is presumed that the relationship between the immigration rate and precipitation is mainly driven by immigration towards the Amazon provinces, particularly to highly rural localities. This is related to the fact that precipitation is higher in this geographic region compared to the coast and the highlands.

This research paper has the following structure: Section II summarizes the main concepts and theories of migration. Section III recapitulates the existing literature on the effects of climatic shocks on internal displacement across different countries. Section IV gives a background and a contextualization of the research problem for the case of Peru, and it mainly describes some stylized facts about recent internal migration patterns and an assessment of climatic variations in the past decades. Section V describes the key features of the data used. Section VI presents the methodology, a description of the variables employed, how they were operationalized, and the empirical strategy followed. Section VII describes the summary statistics of the variables considered. Section VIII shows an analytical evaluation of the main results. Finally, section IX provides conclusions and some policy recommendations.

II. Conceptual and Theoretical Frameworks:

Understanding the relationship between climatic shocks and internal migration must depart from the definition of concepts and must be grounded in a solid comprehension of the theoretical frameworks underlying internal migration processes. In this sense, indicators of internal migration are derived from these definitions, which are not always stable and unalterable but are a matter of debate. A first definition to be discussed is the concept of migration itself. According to Lee (1966, pp. 49), migration can be described as a "permanent or semi-permanent change of residence," independently of the distance related to such moving and the voluntary/involuntary nature of this action. This broad definition, however, considers migration as a categorical decision without considering the singularities among individuals' migration processes. Under this conceptualization, there are no differences between internal and international migration processes; the motivations and factors behind this decision are unclear, and its nuances are undefined. However, this definition gives a critical starting point due to its broad nature, where migration -or the act of migrating- occurs independently of the conditions in which these processes occur.

However, this definition may need to be revised to grasp the dynamic features of migration, and a deep understanding of said concept needs to account for the heterogeneity of these processes and how social structures shape the different conditions in which migration occurs. Thus, it is relevant to consider that individuals' and households' migration processes are not uniform, and various types of migration take place concerning their contexts, living conditions, and needs. According to Waldinger (2015), forms of migration depend on the destination where individuals move, the duration of the process, the reasons behind the decision, the characteristics of the choices made by agents, and a particular development outcome. Thus, concerning the destination, individuals and families may decide to migrate by crossing within-country or international borders -internal and international migration. Regarding the duration, migration can be a seasonal, medium-term, or permanent process. The reasons -or determinants- of migration may be related to climate, economic, political, or social factors that will influence and shape individuals' and families' decisions. Finally, migration choices can emerge from a rational and voluntary decision or from forced situations that may oblige them to cross territorial boundaries. The latter is mainly related to "exogenous shocks" or a disruption of the normal state of things within a society.

This paper focuses mainly on weather variations as a critical determinant of internal migration in Peru, disregarding whether the decisions are made forcedly or voluntarily. In this sense, it is relevant to mull over the potential channels of how weather shocks affect migration decisions among individuals and families. The relationship between climate shocks and internal migration processes does not arise mechanically or in a vacuum but is determined by intermediate mechanisms that motivate individuals to make these decisions. One key mechanism on how climate variations may influence migration decisions is through income loss. As Borjas (2014) indicates, discrepancies between two localities' incomes may influence emigration from the areas where income is lower; in this sense, emigration can be interpreted as a function of the mean income in a receiving locality, the mean income in the source area, and the migration costs, where the former is related positively to the emigration decision and the two following variables are negatively related[5]. This theoretical formalization is also associated with the proposition formulated by Hicks (1963, pp. 76), where he argues that "differences in net economic advantages, chiefly differences in wages, are the main causes of migration." Thus, if climate change is presented as a driver of income loss in a particular location, it may influence people's decision to migrate. Likewise, climate shocks may significantly influence migration from rural localities -mostly in developing countries- because agriculture strongly depends on rainfall in these settings. In this sense, weather variations can affect productivity and individuals' migration decisions (Waldinger, 2015).

Another theoretical concern is related to the places where people tend to migrate. In other words, what the characteristics of the receiving localities are. Ravenstein (1889) built an extensive theoretical body about migration and defined the so-called "seven laws of migration." In this sense, an accurate indicator of migration costs can be defined as the distance an individual has to go to a destination. This way, people tend to migrate to areas close to the source localities. Likewise, cities and regions with a greater growth population rate are usually the destinations for migrating people.

Many of these conceptual and theoretical aspects are considered in the present investigation. Thus, the broad definition of migration is considered to specify who is a migrant, and to estimate the immigration and emigration indicators. Likewise, it includes the potential mechanisms by which climate migration occurs, specifically through the effects of climatic variations on income and local economic activity, for which socioeconomic variables are included in the empirical strategy. Finally, the notion of "migration costs" is captured by

[5] Formally: $I = \log\left(\frac{w_1}{w_0+C}\right)$; where I is an index function and indicates whether a person emigrates; w_1 represents the earnings in a receiving country; w_0 the earnings in a source country; and C measures the migration costs.

considering the intra-province migration indicator as a "proxy" of the distance a person travels in its migration process, which also reflects the relocation costs. Some theoretical and conceptual aspects, however, remain outside the scope of this analysis, such as the reasons and temporality of migration. Hence, a household-level sample would be more appropriate to explore these aspects. This represents a strong limitation for the present study.

III. Empirical Evidence on Climate Migration:

Traditionally, the literature on internal and international migration has focused on understanding the economic and political factors that lie behind these decisions. However, the empirical evidence about climate variation-related displacement has increased over the past years. Many of these studies not only explore the ways in which environmental changes influence migration dynamics, but also investigate how climatic factors interact with other socioeconomic dimensions to generate mobility processes. In this way, migration decisions cannot be attributable to a single factor. Thus, the literature on the impacts of climate change on migration dynamics is distinguished, on the one hand, by understanding local processes - or internal migration patterns- and, on the other hand, international movements. Likewise, some of these studies exploit the exogenous dimension of climate variability -such as disasters or natural shocks-, while others focus on processes of gradual environmental degradation (Waldinger, 2015).

For instance, Barrios, Bertinelli, and Strobl (2006) analyze how climate change positively impacted rural-to-urban migration in sub-Saharan Africa. According to the authors, there has been a significant reduction in precipitation in the African continent, which peaked in the 1960s. Likewise, agriculture is heavily dependent on rainfall compared to other developed countries worldwide. This long-term decline in rainfall prompted critical effects on economic activity. In this sense, climatic shocks are presented as a direct cause of migration, affecting rural populations' living conditions. The authors define some sub-Saharan countries as part of the treatment group, while other developing countries as controls. They find that rainfall has been a vital driver of urbanization processes within this geographical area, where the effect was significantly higher after the decolonization period -after the flexibilization of migration restrictions in most countries.

In a similar line, Marchiori et al. (2012) also study the impacts of weather abnormalities on migration patterns in sub-Saharan Africa, concretely in rural-to-urban displacement. The authors identify that at least 5 million people migrated from 1960 to 2000 due to local weather anomalies, representing 0.3 per thousand individuals annually. Moreover, migrants are attracted principally to urban areas. This explains why the authors consider that urbanization processes alleviate these weather shocks; in this sense, by exploring the potential channels explaining why urban areas are presented as having an "attraction force" for internal migrants, the authors find that this occurs via wages and the economic geography channel.

Robalino et al. (2015) investigate the effect of hydro-meteorological emergencies, such as cyclones, hurricanes, and heavy rainfall, occurred between 1995 and 2000 on internal migration in Costa Rica. The authors run several regressions considering inter-cantonal migration rates to control for a "gravity effect" and the influence of population size on migration flows. They find that a greater occurrence of hydro-meteorological calamities in the canton of origin positively affects migration rates by 0.08 and 0.11 percentage points of the whole population in the canton of origin. These regressions control for socioeconomic and demographic characteristics in origin and destination locations. Likewise, the authors assess whether the various emergencies affect migration rates differently. These findings reveal that less drastic emergencies had a more significant effect on emigration rates from the affected localities.

Beine and Parsons (2015) explore the effects of natural disasters and long-term climatic variations on international migration by using a large country-level panel data set that captures bilateral migration flows from 1960 to 2000. Although they do not find a direct relationship between short-term and long-term climatic shocks and international mobility, the results are robust after considering return migration patterns. Moreover, climate contingencies are more likely to affect short-run and internal movements. Then, they find that reductions in the level of precipitation limits migration to developing countries from countries that depend more significantly on agriculture. Instead, it stimulates mobility towards developing countries from countries with fewer groundwater reserves.

The findings presented in these investigations will be of greater relevance to exploring the underlying mechanisms by which climatic shocks influence internal migration patterns in Peru. On the other hand, the evidence described is contingent. In some cases, excess rainfall has led to lower levels of migration, while in other cases, it has driven emigration processes towards cities and facilitated urbanization processes. The dynamics of this relationship will be analyzed in this study.

IV. Contextualization of the Research Problem in Peru:

IV.1. Recent Internal Migration Patterns in Peru:

In 2017, the Statistics Bureau of Peru conducted a population census to obtain information about the population's dwellings' conditions, such as access to essential services, as well as the demographic and socioeconomic characteristics of the population. The population-level information in the census provided data on internal and international migration patterns, specifically on movements that took place between 2012 and 2017. The census asks whether an individual migrated from one district, province, or region to another in the last five years. Nearly 11 percent of the total population migrated from one district to another between 2012 and 2017 (INEI, 2017). In this way, 565 out of the 1,874 districts that compose the Peruvian territory showed a population growth between 2007 -the year in which the previous census was conducted- and 2017, at an average rate of one percent per year. According to Huarancca et al. (2022), this population growth was not directly associated with a greater birth rate or a reduction in the mortality rate but with more significant migration flows towards these localities.

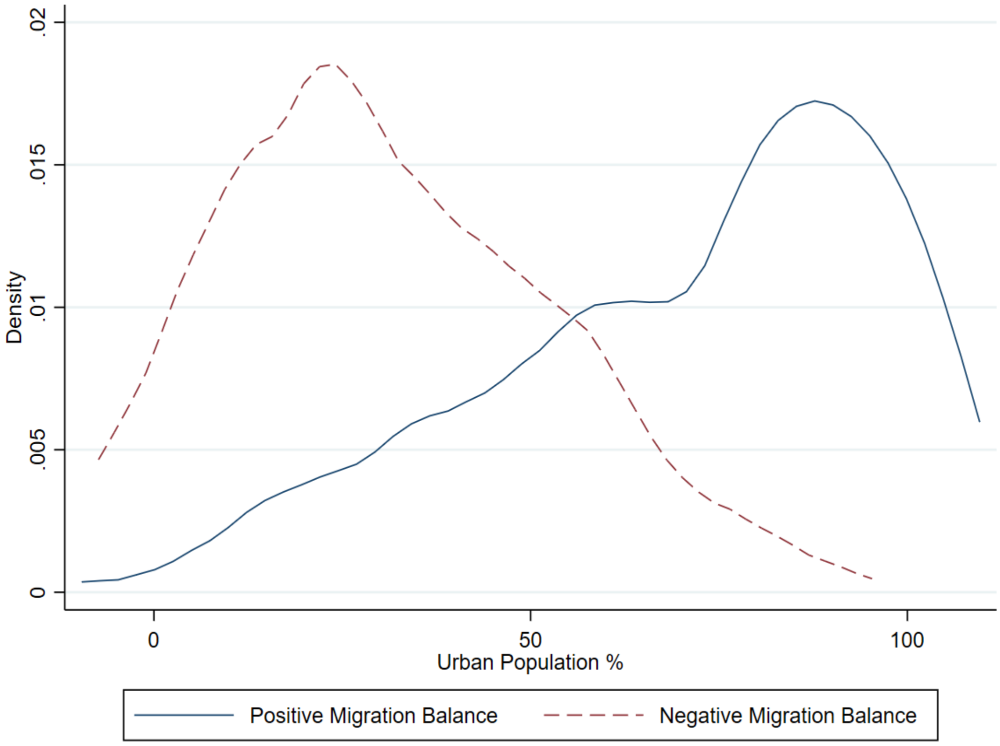
Figure 1 depicts this relationship at the province level. It shows that migration is strongly related to changes in provinces' population composition; while localities that had a more significant population growth presented a positive migration balance rate, provinces that exhibited a reduction in their populations had a negative migration balance, as the linear relationship illustrates.

Figure 1:Population Growth Rate (2007-2017) and Migration Balance Rate (2017)

Source: Statistics Bureau of Peru. National Population Census 2007 and 2017. Based on Huarancca, Alanya, and Castellares, 2022.

Furthermore, during this period, internal migration in Peru followed a rural-to-urban pattern, which persisted from the last century to the present. Figure 2 shows the relationship between the migration balance rate and the urban population rate. The red dashed line exhibits the density distribution of the provinces with a negative migration balance rate. In contrast, the blue line depicts the trend for provinces with positive values. It is observed that the provinces with negative migration balance present a lower urban population rate, meaning that the localities with a larger share of rural population "push" their population towards other areas or, in other words, the number of emigrants from these localities exceeds the total number of immigrants. Analogously, the provinces with positive migration balance values are more likely to be more urbanized than those with negative values. In this way, internal migrants are more prone to emigrate from rural areas to urban localities.

Figure 2: Internal Migration (2012-2017) and Urban Population Rate (2017)

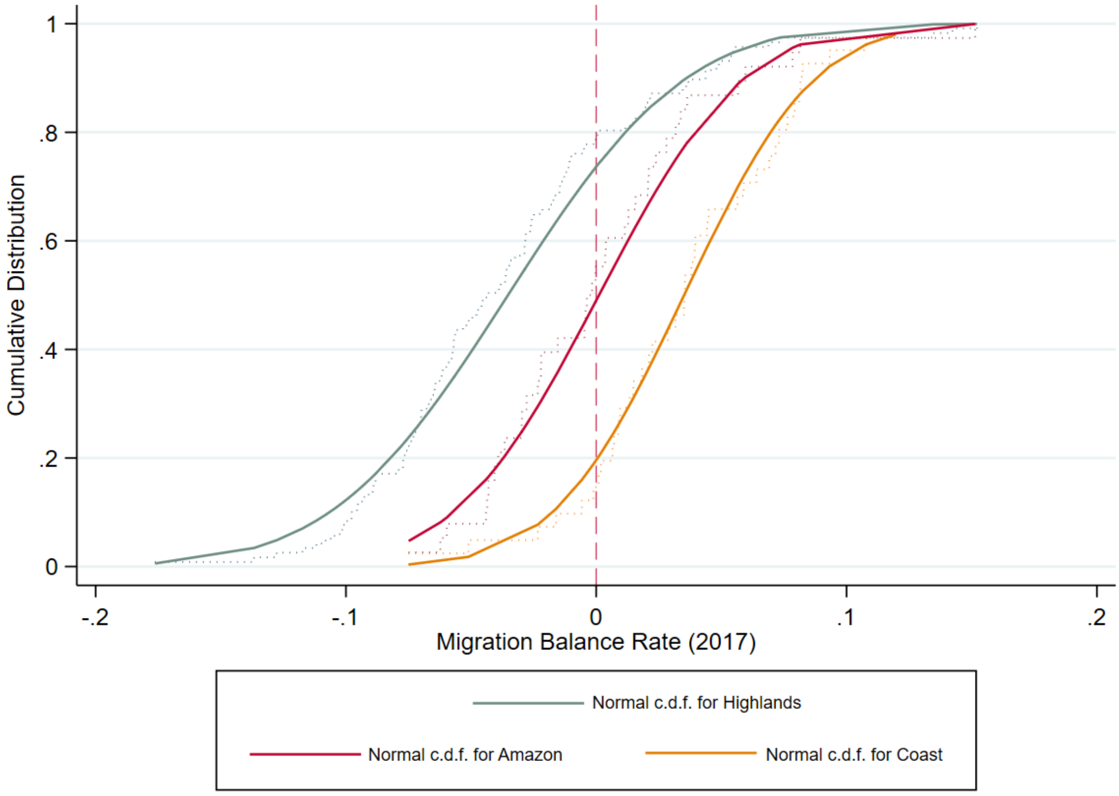


Source: Statistics Bureau of Peru. National Population Census 2007 and 2017. Based on Huarancca, Alanya, and Castellares, 2022.

Similarly, in recent years, internal migration in Peru has been predominantly towards coastal provinces. It is important to highlight that the Peruvian territory is geographically divided into three regions: the coast, the highlands, and the Amazon. As depicted in Figure 3, where the adjusted normal cumulative distribution function of the migration balance rate of each region is plotted, most of the coastal provinces (represented by the yellow-colored curve) presented a positive migration balance rate compared to provinces from the Amazon (red-colored curve) and the highlands (blue-colored curve). Likewise, most of the provinces from the Amazon region have positive migration balance rates -but not as much as the coastal provinces-. In contrast, most of the provinces located in the highlands have a larger number of emigrants in relation to their number of immigrants. This means that most migrants move towards coastal areas and, to some extent, to the Amazon[6].

[6] According to data from the Statistics Bureau of Peru, between 1993 and 2017, the coast experienced a population increase of 63 percent, while in the highlands and the Amazon, these values were 41 and 58 percent respectively.

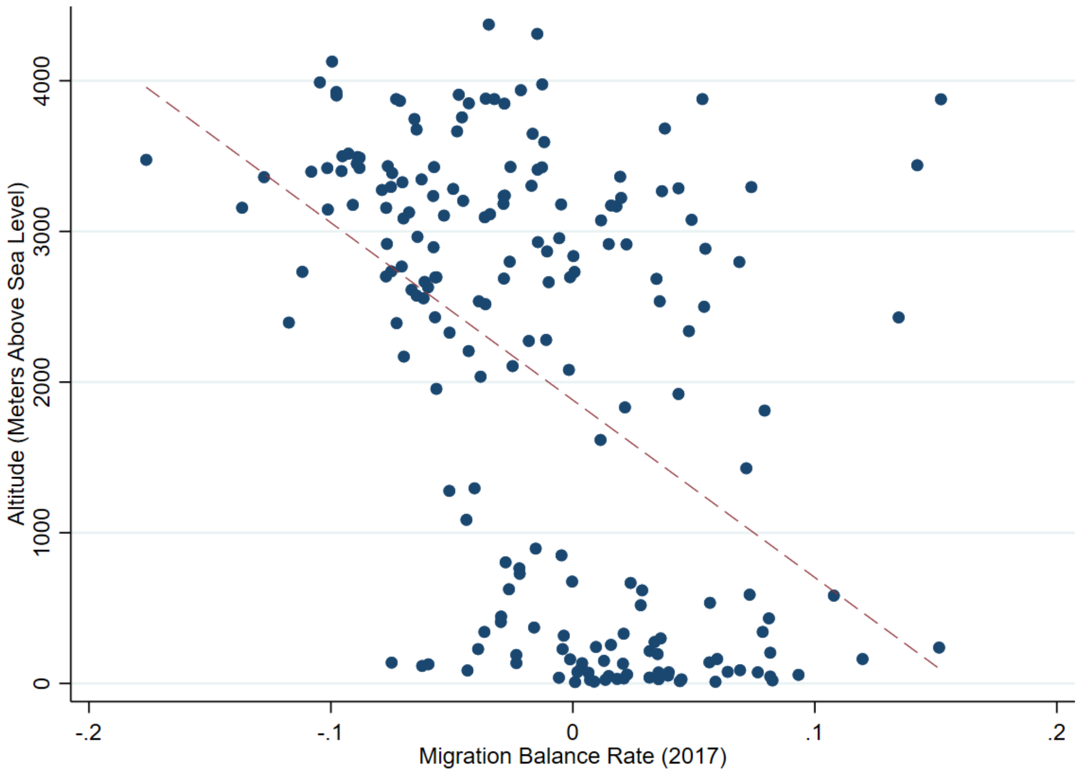
Figure 3: Migration Balance Rate (2017) Normal Cumulative Distribution by Geographic Region



Source: Statistics Bureau of Peru. National Population Census 2007 and 2017. Based on Huarancca, Alanya, and Castellares, 2022.

Finally, Figure 4 shows the relationship between the average altitude at which a province is located -measured by the meters above sea level- and its migration balance rate. It is possible to identify a negative association between both variables. This indicates a migration pattern from high-altitude areas to lower-altitude localities. This coincides with the results depicted in Figure 3, where coastal and Amazon provinces, which are low-altitude areas, tend to have a higher proportion of immigrants and a lower number of emigrants than localities from the highlands. In this way, the provinces located at a higher altitude tend to have a negative migration balance rate, and as the altitude decreases, the migration balance increases continuously.

Figure 4: Migration Balance Rate (2017) and Altitude (Meters Above Sea Level)



Source: Statistics Bureau of Peru. National Population Census 2007 and 2017. Based on Huarancca, Alanya, and Castellares, 2022.

In sum, the recent internal migration processes in Peru, particularly between 2012 and 2017, show that mobility continues to be predominantly towards urban areas, as well as towards coastal regions and, to a certain extent, provinces of the Amazon. Today, nearly 55 percent of the Peruvian population resides in coastal cities, and its "pulling" nature is linked to the fact that most of the big and mid-cities are in this geographic region. Various non-traditional economic activities are concentrated in these localities, such as the food industry, the agro-industrial activity -which is predominantly export-oriented-, and commercial and service activities that absorb a significant proportion of the labor force. Furthermore, the importance that the Amazon has acquired in the past years as a "pole of attraction" for internal migrants is related to its endowments of natural resources that makes possible the development of different economic activities such as the exploitation of wood, hydrocarbons, and mining activities that "pull" people from other areas and are employed in these industries (Sánchez, 2015). In general, the influence exerted by the primary export economic development model adopted since the beginning of the 20^{th} century on local development has been transcendental in the emergence of new migration patterns, which, in turn, have had diverse impacts on the localities of origin and destination.

Thus, Aldana and Escobal (2016), using a pseudo-panel at the province level for the years between 2007 and 2014, explore the various effects of migration in the origin and destination areas. They find that migration has a positive impact on the average educational level of the receiving provinces, indicating that people who migrate have a relatively higher education level. That is, migration improves the human capital among the localities that tend to attract more migrants. On the other hand, from a demographic perspective, migration impacts the level of aging of the population in the areas of origin since people with greater educational capital, predominantly young people, are the ones who emigrate. This, in turn, is related to a decrease in the level of consumption in the origin provinces, particularly in those with a relatively higher level of development and wealth. In other words, the loss of human capital in the localities of origin is closely related to lower levels of well-being -measured as the spending capacity of individuals. This relationship is presented as the counterpart of what happens in the receiving provinces, where immigration generates a significant increase in the average expenditure of the locality.

IV.2. Time Series of Precipitation in Peru:

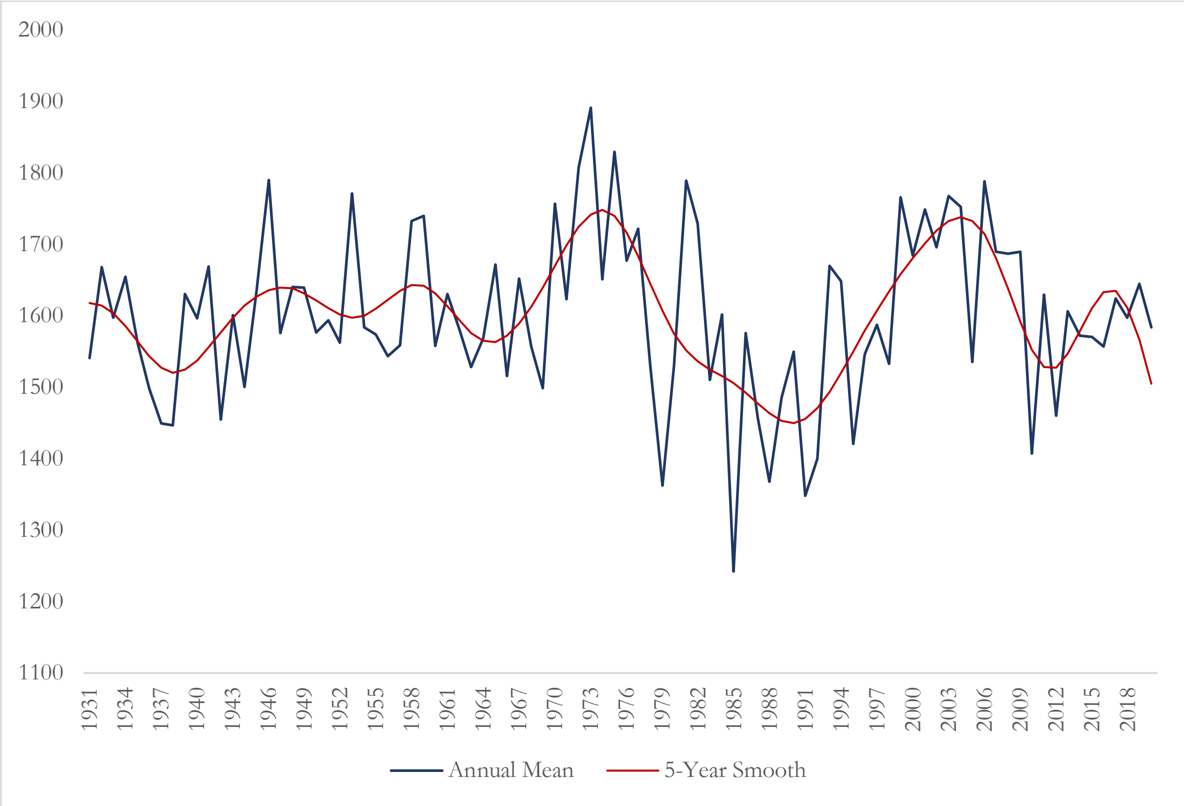
Peru is a diverse country, with an area of more than 1.2 million square kilometers, 38 types of climates, and 8 natural regions, extending from the Pacific Ocean, crossing the Andes, to the Amazon (Ponce de León, 2000). In this way, precipitation is not homogeneously distributed throughout the territory. Moreover, Peru is a country with high vulnerability and exposure to natural disasters compared to others that are structurally similar, such as Ecuador, Colombia, and South Africa. Thus, adverse climate shocks, such as El Niño[7], make Peru one of the most affected countries by climate change. Likewise, the significant share of agriculture and fishery in the national GDP also puts the country in a context of high risk, being these sectors largely affected by climatic shocks (World Bank Group, 2022).

Figure 5 shows these heterogeneous climate patterns over time. In general, the trajectory of precipitation levels between 1931 and 2020 remains relatively stable, with a negligible negative trend. However, large deviations from this trend are observed, which occur periodically. In this sense, this trajectory has shown several positive and negative peaks within this time frame. The most severe positive rainfall shocks occurred in 1946, 1953, 1973, and 1982, mainly related to the El Niño phenomenon (MINAM, 2015). In contrast, the most severe negative shocks occurred in 1979, 1985, and 2010. The impacts of these events were catastrophic. Thus, during the 1982-1983 El Niño phenomenon, which was categorized as extremely intense, the economic losses were close to 3,283 million dollars (MINAM, 2015), while in 1985, losses reached 3,138 million dollars as a direct consequence of these adverse shocks (Poveda et al., 2020).

---

7 The El Niño phenomenon, technically known as El Niño Southern Oscillation (ENSO), occurs when the surface temperature of the Pacific Ocean increases abnormally. This cyclical phenomenon is related to increases in severe rainfall in the areas near the Pacific coasts of South America. The related changes in the weather patterns impact agriculture, the fishing sector, the construction industry, and local and international price levels (Cashin, Mohaddes, and Raissi, 2017).

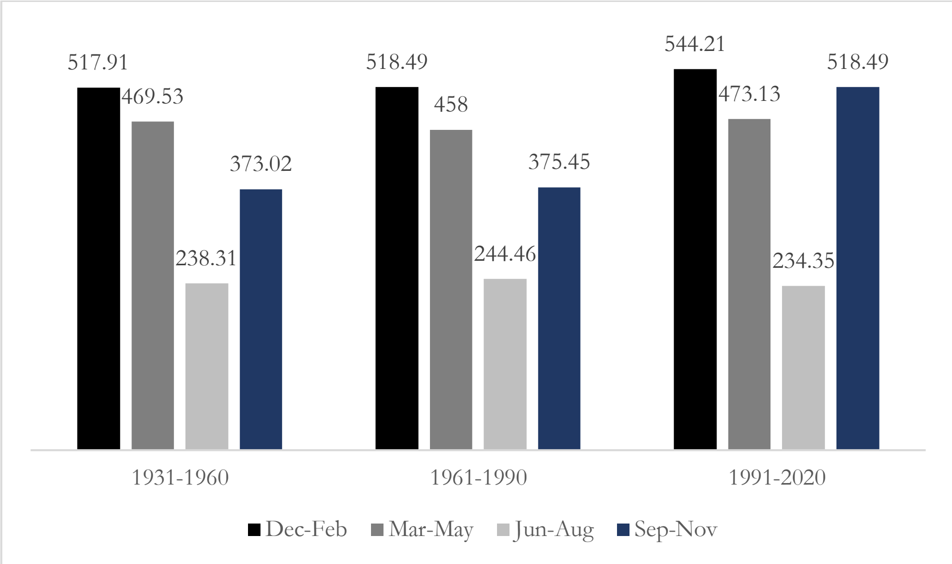
<u>Figure 5: Time Series of Precipitation (1931-2020)</u>



Source: Climate Change Knowledge Portal (World Bank Group). Based on the Climatic Research Unit (CRU) of the University of East Anglia.

Figure 6 describes the average rainfall that occurring in each quarter for different time periods. There is more precipitation accumulation between December and February, which coincides with the southern hemisphere summer. These values were greater than 500 millimeters in each of the time cuts. On the other hand, the driest quarter goes from June to August, where rainfall reaches more than 200 millimeters on average.

Figure 6: Quarterly Average Precipitation in Millimeters (1931-2020)



Source: Climate Change Knowledge Portal (World Bank Group). Based on the Climatic Research Unit (CRU) of the University of East Anglia.

Finally, Table 1 shows the main statistics of the precipitation time series from 1931 to 2020. The mean value for this period was 1,600 millimeters, with a relatively high dispersion. As mentioned, the minimum value during this time span was 1,242 millimeters, coinciding with the year 1985, while the maximum value was 1,891 millimeters in the year 1973, in which the El Niño phenomenon occurred.

Table 1: Summary Statistics of Precipitation in Peru (1931-2020)

	Precipitation (1931-2020)
Mean	1600.75
Standard Deviation	116.81
Minimum Value	1242.25 (1985)
Maximum Value	1891.67 (1973)
Excess Rainfall (Minimum Value) *	-3.069 (1985)
Excess Rainfall (Maximum Value) *	2.491 (1973)
Proportion of Years with Negative Values	53.3%

Proportion of Years with Positive Values	47.7%
Number of Observations	***90***

Source: Climate Change Knowledge Portal (World Bank Group). Based on the Climatic Research Unit (CRU) of University of East Anglia.
*** Measured as the number of standard deviations above (below) the historical mean.**

V. The Data:

V.1. Rainfall Data:

This study uses data from the Climatic Research Unit of the University of East Anglia (CRU TS), concretely version 4.07. It provides georeferenced information on temperature, precipitation, diurnal temperature range, and vapor pressure. The dataset contains individual half-degree cells (50x50-kilometer grids) distributed over different land domains except Antarctica. The precipitation data provides high-resolution, gridded monthly values from 1901 to 2018 in millimeters (Harris et al., 2020). For this study, this is a plausible level of resolution since the average size of the provinces in Peru is nearly 6,531 square kilometers, and the median value is approximately 3,210 square kilometers. Concretely, 74 out of 196 provinces are smaller than one grid, indicating that most provinces are larger than a 2,500 square kilometers cell[8].

Likewise, Sun et al. (2017) elaborate a review of thirty different precipitation data sets and their estimation methods. The authors find significant discrepancies between these sources, and there were deviations up to 300 millimeters in the estimated quantities of annual precipitation. These products are distinguished according to their methods of calculation. This way, the CRU data set uses a gauge-based measure of monthly precipitation, and similar techniques are used by the Global Precipitation Climatology Centre (GPCC) and the University of Delaware (UDEL). Other data sets employ satellite information, while another group of products uses a reanalysis method, where actual observation and forecasts are combined to estimate precipitation values. In the case of the reanalysis-based sources, the authors find greater discrepancies when compared to other data sets. On the contrary, satellite data provide accurate estimates, particularly in complex areas where gauged-based methods are difficult to employ. However, satellite estimations are not directly measured and may derive more discrepancies among their estimations. Finally, gauge-based measures track precipitation changes more directly in different territories. However, global gauge density is still limited, and its distribution across the territory is uneven due to accessibility difficulties -such as oceans, mountain areas, and deserts. In this sense, gauge-based estimates show, to some extent, discrepancies between their sources, and their accuracy depends on the number of stations within a territory, their homogeneity, and how results are analyzed (Sun et al., 2017).

[8] Appendix 1 shows the size in square kilometers and the geographic region of each province in Peru.

Nonetheless, several studies rely on gauge-based methods to estimate the impacts of rainfall shocks in different countries. Vicarelli and Aguilar (2011), for instance, use monthly precipitation data from the University of East Anglia to estimate the impact of El Niño Southern Oscillation (ENSO)-related floods on cognitive and health outcomes in children who were exposed to these hazards in their early life during the end of the agricultural season of 1998 and 1999 in Mexico. Likewise, Pazos et al. (2023) assess the causal relationship between early exposure to rainfall shocks and cognitive skills in Peru, employing precipitation data from the University of Delaware. Shah and Steinberg (2015) also use this data set to estimate the long-term effect of rainfall shocks on human capital in India. Thus, the use of the CRU TS data set is well-supported by the existing literature about the diverse impacts of climate shocks.

In this way, each province is matched with one or two closest grids, and their rainfall values are attributed to each observation. The CRU TS data set has information about the coordinates where the center of a grid is located. Likewise, a province capital is considered a reference point to estimate the distance between the province and the grid, specifically from where the province municipality, the main square, or the police station is located. GPS information was employed to estimate these distances. Single grid values are attributed to each observation for the provinces whose territory sizes are less or equal to 5,000 square kilometers. Whereas for larger provinces, the monthly precipitation is estimated as a distance-weighted average of the two closest grid points to that province, similar to the methodology used by Pazos et al. (2023)[9]. Concretely, the following formula is used to estimate the distance-weighted average using the two closest grids:

$$\frac{w_1 \sum_{m=Dec}^{Mar} prec_{m,t,g} + w_2 \sum_{m=Dec}^{Mar} prec_{m,t,g}}{w_1 + w_2}$$

Where the weights, w_1 and w_2, are defined as the sum of both distances divided by the distance between the grid and the province's capital. These weights are multiplied by the sum of the rainfall values from December to March, $prec$, for period t, and grid g. Finally, this value is divided by the sum of the weights. Thus, 183 grids were used to cover the values of 196 provinces across the Peruvian territory, which also reveals the appropriateness of using a 0.5x0.5-degree land grid cells data set.

V.2. Migration Data and Province Socioeconomic, Demographic, and Geographic Characteristics:

The province-level precipitation data set was merged with data from the National Household Survey (ENAHO) annually conducted by the Statistics Bureau of Peru (INEI). The ENAHO is one the most relevant sources of information for policy decision-making, the formulation of social welfare programs, and the estimation of the incidence of monetary poverty. It

[9] Appendix 2 shows the coordinates of the province's capital, the coordinates of the closest grid center, and the distance between both points in kilometers for provinces with an area less or equal to 5,000 square kilometers. Appendix 3 shows the same information, but for the two closest grids and for provinces with an area greater to 5,000 square kilometers.

provides information at the individual and household levels and has a regional level of inference. This represents a strong limitation for this study since it does not give precise estimates at the province level. However, when household and individual characteristics are weighted using an expansion factor, it yields more accurate calculations.

Regarding the migration variables, the ENAHO questionnaire asks whether an individual lives in the same district, province, or region where they were born. Therefore, a migrant is defined as someone living in a locality other than their birthplace. Migration indicators are derived from this survey's question and were aggregated at the province level, obtaining yearly migration rates for each observation unit. This way, migration indicators, concretely inter-province migration (decomposed by immigration, emigration, and migration balance), and intra-province migration, were constructed employing this variable.

Likewise, the ENAHO provides information about households' socioeconomic, demographic, and geographical characteristics. This information, as well, is aggregated at the province level, and they were used to build control variables. Specifically, variables such as poverty rate, per capita income, and rural population rate were included in the data set as control variables.

V.3. Open Data from the Ministry of Health of Peru:

In 2021, the Ministry of Health of Peru published a detailed data set with information about the geographical characteristics of the districts and provinces contained in the national territory. Key indicators such as altitude, latitude, longitude, and size in square kilometers, are defined in the data. In the case of the latitude and longitude, or the coordinates indicating the precise location of the provinces, the values were considered for measuring the distance between the grid cells and the province capital. Likewise, province size indicators were used to define the number of grids matched with each observation unit.

VI. Methodology, Variables, and Empirical Strategy:

The sources described in the previous section were combined to build a large panel data set at the province level for the period between 2007 and 2010. Likewise, a collection of independent variables, as well as year and province fixed effects, were included to control for time-invariant factors or unobserved heterogeneity, as well as the main variable of interest, which is the sum of the monthly rainfall observed during the rainy season in Peru, which runs from December to March.

Also, a set of dependent variables was defined to assess the effect of precipitation during the rainy season on internal migration patterns. The first indicator is the inter-province migration, decomposed into three sub-indicators: the immigration rate, the emigration rate, and the migration balance rate. The immigration rate is defined as the sum of all individuals who reside in a province, p, other than the one in which they were born, divided by the same province's total population. Analogously, the emigration rate is defined as the sum of individuals who were born in the same province, p, but indicated living in another province by the time the survey was conducted, also divided by the total population. The migration balance indicator represents the difference between the immigration and emigration values. In this sense, provinces whose migration balance are positive are considered as "pulling" or "receiving" localities, whereas areas that have negative values are regarded as "pushing" or "origin" provinces.

However, based on migration theories, mobility is more likely to occur towards localities relatively close to places of origin. In this sense, the distance between a source and a receiving area can be considered a "proxy" measure for individuals' underlying migration costs across this process. Thus, the second migration indicator is the intra-province migration rate. This variable is defined as the sum of total movements within a province at a particular time frame. In other words, a migrant is someone who was born and currently lives in the same region but resides in a district other from which they were born. This variable, thus, considers the intra-migration rate as the total movements within a province divided by the province's total population.

Finally, this study also investigates whether changes in precipitation affect the rural population rate, a "proxy" variable to assess if rural-urban migration patterns persist over time. It is important to consider that the rural population rate may also be regarded as an explanatory variable to examine the effects of rainfall on inter and intra-migration patterns. However, it is also appraised as an outcome variable. Therefore, it is defined as a regressor in these estimations but considered a variable of interest for assessing rural-to-urban migration patterns. This way, the rural population rate is defined as the fraction of the population in rural settings divided by the province's total population. Nonetheless, using this indicator as a "proxy" of rural-to-urban migration struggles with a crucial limitation, which lies in the impossibility of understanding the mechanism by which the share of the rural population varies over time, which could be either an effect of immigration or emigration.

Likewise, socioeconomic, demographic, and geographic control variables are included in the estimates. Specifically, time-variant province characteristics such as poverty rate -defined as the proportion of individuals that have a monetary income below the poverty line- and per capita income -regarded as the sum of all households' incomes divided by the total population. Likewise, province fixed effects were considered to control for the provinces' time-invariant and non-observable characteristics. An important consideration regarding including province fixed effects is that Peru has a decentralized government structure, particularly at the regional and local levels (provinces and districts). Thus, political decisions taken at the province level have significant repercussions on their economic and social development. Likewise, by considering province fixed effects, unobserved geographical, cultural, and environmental non-observed factors, namely spatial heterogeneity, are also controlled in the estimates, which may influence internal migration patterns.

Finally, the regressor variable of interest in the following study captures the amount of rainfall in millimeters during the rainy season between 2007 and 2010. In this way, this variable was calculated as the sum of the monthly rainfall that occurred between December and March of each period[10]. It is crucial to consider that for a particular year, t, measurements considered in December were from the previous period, $t-1$. In other words, measures for a specific period also consider the amount of precipitation that occurred in December of the prior year. This way, this research focuses on understanding whether precipitation during

[10] Appendix 4 shows the precipitation values for each province and year.

the rainy season in Peru -which coincides with the southern summer period- affect the previously described internal migration patterns.

Likewise, the quadratic value of the regressor variable of interest was also considered to identify non-linearities in the relationship between internal migration patterns and precipitation. It is important to note that rainfall and migration are not necessarily linearly related, and precipitation effects can be heterogeneous. In other words, there are certain levels of rainfall that may be tolerated and expected by individuals. When the amount of rainfall exceeds or is below a certain acceptable level, migration may take place as an adaptation measure and risk mitigation strategy. In this sense, the quadratic term of precipitation captures these limits and the heterogeneity of its effects based on its magnitude.

The empirical strategy adopted to estimate the effect of precipitation on internal migration patterns consists of a fixed-effects model, and it is based on the aggregation of province data for the estimation of the parameters of interest. In other words, the observations were pooled, and the ordinary least squares (OLS) method was applied to calculate the coefficients. The following equation was estimated to assess the relationship:

$$Y_{p,t} = \beta_0 + \sum_{i=1}^{2} \beta_i \left(sum\_precipitation_{p,t}\right)^i + X'_{p,t}\gamma + \tau_t + a_p + \varepsilon_{p,t}$$

Where $sum\_precipitation$ represents the sum of the monthly precipitation from December to March for province, p, and period, t. X represents a vector of time-variant province characteristics. Finally, the equation controls for time fixed effects, τ, and province fixed effects, a. The error term is captured by ε, for each province and period. The dependent variable, Y, represents all the migration patterns described previously; that is to say, inter-province migration and its three sub-indicators (immigration, emigration, and migration balance), intra-province migration, and rural population rate. This way, β_1 and β_2 are the parameters of interest. Also, given the wide differences in migration patterns between Peru's geographic regions, this same specification will be split, and migration patterns from the coast, the highlands, and the Amazon will be independently assessed.

An important advantage of using a panel data set is that it allows the enlargement of the number of observations by pooling or stacking them as many times as the number of defined periods. However, controlling for the correlation between provinces' errors over time is crucial when pooling the data. In this case, a pooled OLS estimation treats all the observations in the data set as independent. Thus, a fixed-effects model may be appropriate to allow for unobserved individual heterogeneity that may be correlated with the regressors. An OLS approach may yield biased parameters if these variables are ignored, causing the so-called omitted variable bias (Cameron and Trivedi, 2005). This way, the OLS estimators are expected to be consistent and unbiased after including the province and year fixed effects.

Nevertheless, measurement errors are likely to occur, especially considering that the CRU TS data set uses a gauge-based method to estimate monthly precipitation. Therefore, following Maccini and Yang (2009), instrumental variable regressions are performed to control for calculation errors. Thus, the sum of the monthly precipitation is instrumented with a rainfall variable from the third or fourth closest grid from the province's capital location[11]. The rationale behind this approach is that rainfall from the third or fourth closest cells is far enough away from the point of reference. It is assumed that it does not directly affect internal migration patterns in this locality and correlates to precipitation from the closest grids. In this sense, a two-stage least square approach is used to obtain the estimates. The reduced-form equation is defined as follows:

$$sum\_precipitation_{p,t} = \alpha_0 + \alpha_1 sum\_precipitationIV_{p,t} + X'_{p,t}\delta + \tau_t + a_p + v_{p,t}$$

In this case, the dependent variable is the of the sum of the monthly precipitation from December to March for the province and period of interest. Also, the control variables and the time and province fixed effects are included in the model. The instrument, that is, $sum\_precipitationIV$, measures the sum of the monthly precipitation in the third or fourth closest grid from the province's capital. The error term is defined as v. Therefore, the structural equation is defined as:

$$Y_{p,t} = \lambda_0 + \sum_{i=1}^{2} \lambda_i \left(\widehat{sum\_precipitation_{p,t}}\right)^i + X'_{p,t}\eta + \tau_t + a_p + \mu_{p,t}$$

Where Y stands for each of the internal migration patterns, and $\widehat{sum\_precipitation}$ is the predicted value of the first stage's dependent variable. This way, λ_1 and λ_2 are the parameters of interest.

Some key criteria that define whether an instrument is valid cannot be directly tested. However, it is presumed that this instrument may be appropriate to attenuate potential measurement errors. It is possible to indicate that the instrument is relevant considering that a strong correlation, concretely of 0.85, between the two precipitation indicators is given. Also, it is expected that the exclusion restriction holds since, theoretically, rainfall from a distant locality should not affect migration patterns in a particular province. The results of the instrumental variable regression are presented as a robustness test and will be contrasted with the simple OLS outcomes.

In addition to these results, the unexpected nature of precipitation is also explored. To do so, four dummy variables were built distinguishing different cut-off points, which measure the magnitude of the deviation of a specific precipitation value, for a particular period, province, and month, with respect to its historical average, divided by its historical standard deviation. Formally, following Rosales-Rueda's (2018) methodology, an excess rainfall indicator is defined by the following equation:

[11] Appendix 5 shows the third/fourth closest grid coordinates, as well as the sum of monthly precipitation values for each of them.

$$excess\_rainfall_{p,t,m} = \frac{Prec_{p,t,m} - \overline{Prec}_{p,m}}{\sigma_{p,m}}$$

Where $Prec$ is the value of the rainfall amount in millimeters that occurred in province, p, in period, t, and in month, m. On the other hand, $\overline{Prec}$ stands for the historical precipitation mean from 1961 to 2010 for the same province and in the same month. This difference is divided by σ, which represents the historical standard deviation of the same time frame and month analyzed. In this way, a rainfall shock can be defined when one of the following two conditions are satisfied:

$$(rainfall\_shock_{p,t} = 1) = \left(\frac{1}{4}\sum_{m=Dec}^{Mar} excess\_rainfall_{p,t}\right) \geq V$$

$$(rainfall\_shock_{p,t} = 1) = \left(\frac{1}{4}\sum_{m=Dec}^{Mar} excess\_rainfall_{p,t}\right) \leq -V$$

Thus, $rainfall\_shock$ represents a dummy variable that takes the value of one if either of the two previous conditions is met and zero otherwise. In other words, it equals to one if the average of the variable $excess\_rainfall$ from December to March is greater or equal than the cut-off point, V, or less or equal than the cut-off point, $-V$.

As a result, several sensitivity tests using different cut-off points, specifically 0.5 (-0.5), 0.6 (-0.6), 0.75 (-0.75), and 0.9 (-0.9) were performed to identify heterogeneous effects based on the magnitude of the rainfall shocks[12]. Finally, this indicator, specifically for the 0.75 (-0.75) and the 0.9 (-0.9) cut-off points, was split into three dummy variables, distinguishing the presence of positive, negative shocks, and the non-presence of any shock in the province. This way, these dummy indicators were included separately in the main specification to assess changes in the estimated parameters of interest, that is, the effect of precipitation on internal migration patterns, and evaluate differences in the presence of these shocks.

VII. Summary Statistics:

This section shows the descriptive statistics of the variables considered in this study[13]. Tables 2 through 4 display the mean and standard deviation of the variable concerning the migration patterns in Peru, of the control variables, and the regressor of interest, that is, the sum of the monthly precipitation between December and March of each period. Furthermore, some precipitation variables aimed at assessing the unexpected nature of rainfall are included. As mentioned previously, a positive rainfall shock occurs in a province when the average of the differences between the monthly rainfall value and the historical average of said month for

[12] Different cut-off points have been identified in the literature on the impacts of rainfall shocks on various outcomes. See, for example, Pazos et al. (2023), Aguilar and Vicarelli (2011), Rosales-Rueda (2018), Díaz and Saldarriaga (2023).

[13] Appendix 6 shows the values for the dependent variables for each province and year.

the period between 1961 and 2010 from December to March is greater or equal to 0.75 standard deviations from the historical dispersion of the same period. Analogously, a negative shock follows the same rationale, but in this case, the average of the deviations between December and March in a specific period is less or equal to -0.75.

Table 2 depicts the statistics for the full sample. It shows that, overall, the migration balance rate is negative, which indicates that most of the provinces in Peru are predominantly "pushing" their populations towards other localities. In other words, emigration exceeds immigration. The migration balance rate is nearly -34 percent, while the immigration rate's value is close to 23 percent, and the emigration rate is around 59 percent. On the other hand, the intra-province migration rate is significantly lower, reaching more than 9 percent on average. Regarding the control variables, the rural population represents nearly 62 percent of the population, and the poverty rate reaches more than 52 percent. Finally, the average per capita income is about 2,715 soles (901 USD)[14]. Regarding the rainfall indicators, it is observed that the average of the sum of the monthly precipitation between December and March is 474 millimeters. Likewise, more than 17 percent of the sample had a positive rainfall shock, while only nearly 2 percent presented a negative shock. Overall, most of the provinces showed rainfall values within the normal range, that is, between -0.75 and 0.75 standard deviations from the historical value.

Table 2: Summary Statistics of Variables (Full Sample)

	Full Sample		
	Mean	***S.D.***	***N***
Migration balance rate	-0.336	0.476	762
Immigration rate	0.228	0.159	762
Emigration rate	0.587	0.474	772
Intra-province migration rate	0.092	0.082	730
Rural population rate	0.619	0.339	772
Poverty rate	0.522	0.248	768
Per capita income	2715.050	1994.491	772
Sum of monthly precipitation	474.199	348.938	784
Positive rainfall shock (≥0.75) (Yes=1)	0.173	0.379	784
Negative rainfall shock (≤-0.75) (Yes=1)	0.017	0.128	784
No rainfall shock (Yes=1)	0.810	0.393	784

[14] 1 USD=3.013 Soles on average for the monthly nominal exchange rate from December 2006 to March 2010 according to the Central Bank of Peru.

Table 3 displays the same statistics by year. The migration balance rate is negative in every year considered in the analysis, which implies that the emigration rate is larger than the immigration year from 2007 to 2010. Also, the migration balance rate remains relatively stable over time, and it does not present important changes from one year to another. The immigration and emigration rates follow similar trends. Concerning the controls, the rural population rate also remains constant over time, and it does not show significant differences, remaining above 60 percent in all years. On the contrary, the poverty rate has been considerably and significantly reduced, falling from 59 percent in 2007 to 46 percent in 2010. Similarly, the average income per capita increased progressively, going from 2,352 soles in 2007 to 3,088 in 2010. Finally, rainfall also remained relatively stable over this period, and the minimum value was 425 millimeters in 2007, and the maximum was 504 in 2009. However, a high heterogeneity is exhibited in terms of the proportions of provinces that presented a positive rainfall shock. While in 2007, almost 2 percent of the provinces had excess rainfall, in 2009, the proportion was almost 30 percent. In contrast, from 2007 to 2009, no province exhibited negative rainfall shocks, while in 2010, the proportion reached almost 7 percent of the observations.

Table 3: Summary Statistics of Variables by Year

	2007			2008		
	Mean	***S.D.***	***N***	***Mean***	***S.D.***	***N***
Migration balance rate	-0.346	0.519	190	-0.332	0.472	190
Immigration rate	0.234	0.167	190	0.227	0.159	190
Emigration rate	0.599	0.463	193	0.590	0.520	193
Intra-province migration rate	0.092	0.082	180	0.090	0.084	186
Rural population rate	0.627	0.336	193	0.622	0.338	193
Poverty rate	0.588	0.236	192	0.534	0.251	192
Per capita income	2352.448	1896.217	193	2614.727	1985.901	193
Sum of monthly precipitation	425.232	333.586	196	475.496	377.246	196
Positive rainfall shock (≥0.75) (Yes=1)	0.026	0.158	196	0.173	0.380	196
Negative rainfall shock (≤-0.75) (Yes=1)	.	.	.	.	.	.
No rainfall shock (Yes=1)	0.974	0.158	196	0.827	0.380	196

Table 3 (Continued): Summary Statistics of Variables by Year

	2009			2010		
	Mean	***S.D.***	***N***	***Mean***	***S.D.***	***N***
Migration balance rate	-0.330	0.452	191	-0.337	0.461	191
Immigration rate	0.223	0.152	191	0.227	0.160	191
Emigration rate	0.576	0.462	193	0.585	0.450	193
Intra-province migration rate	0.091	0.082	185	0.094	0.081	179
Rural population rate	0.618	0.342	193	0.612	0.342	193
Poverty rate	0.508	0.250	192	0.459	0.239	192
Per capita income	2805.005	2057.916	193	3088.023	1977.226	193
Sum of monthly precipitation	504.282	319.927	196	491.784	359.62	196
Positive rainfall shock (≥0.75) (Yes=1)	0.296	0.458	196	0.199	0.400	196
Negative rainfall shock (≤-0.75) (Yes=1)	.	.	.	0.066	0.249	196
No rainfall shock (Yes=1)	0.704	0.458	196	0.735	0.443	196

On the other hand, there are significantly wide differences in precipitation and migration patterns between Peru's geographic areas, namely the coast, the highlands, and the Amazon. As mentioned, the results of the 2017 census show that most of the coastal and Amazonian provinces had a positive migration balance rate, while in the highlands, there is a "push" towards other areas. In that sense, Table 4 shows the dissimilarities between these statistics by geographic area. Unlike the 2017 census results, for this study's period of analysis, the Amazon reached a positive migration balance rate, while in the coast, this indicator was negative. The highlands, in a similar fashion to the census results, presented a comparatively higher negative value of this migration indicator.

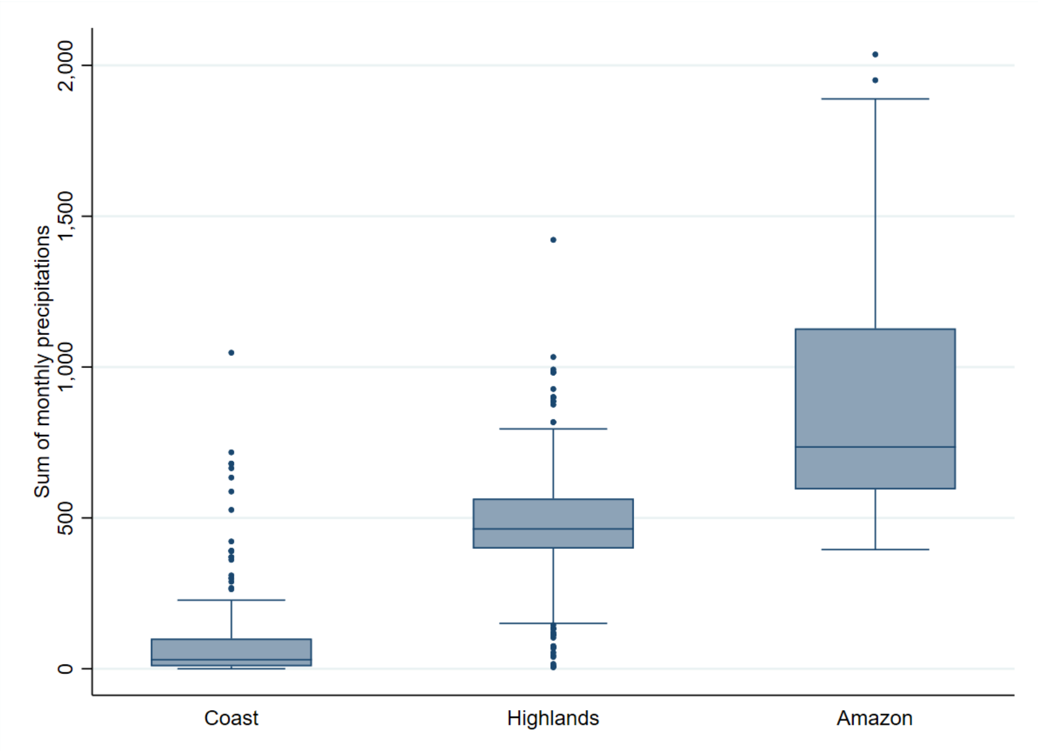
Thus, between 2007 and 2010 the predominant migration pattern was towards provinces located in the Peruvian jungle. Nevertheless, the coast showed a larger rate of intra-province migration, from which it can be inferred that coast-to-coast migration patterns are of great relevance. Likewise, in parallel with most official estimates, the coast is the region with the smallest share of rural population. About 27 percent of the coastal population lives in rural areas. Conversely, 75 percent of the highlands' population live in rural localities, and in the Amazon, 59 percent. Moreover, the poverty rate was almost 30 percent in the coast, whereas in the highlands and in the Amazon 61 and 51 percent respectively. Regarding the average income per capita, the coast presents the highest value in relation to the other regions, since per capita income was around 44 percent of the coastal income, and that of the Amazon, close to 61 percent. Also, these three regions present significant differences regarding their precipitation values. In the coastal provinces, the average value of precipitation is almost 100 millimeters during a rainy season, while this value reaches 468 millimeters in the highlands, and 894 in the jungle. Figure 7 depicts the mean differences between rainfall by geographic region.

Table 4: Summary Statistics of Variables by Geographic Region

	Coast			Highlands			Amazon		
	Mean	***S.D.***	***N***	***Mean***	***S.D.***	***N***	***Mean***	***S.D.***	***N***
Migration balance rate	-0.075	0.317	164	-0.548	0.461	450	0.018	0.272	148
Immigration rate	0.339	0.339	164	0.151	0.117	450	0.339	0.151	148
Emigration rate	0.414	0.295	164	0.735	0.524	460	0.321	0.222	148
Intra-province migration rate	0.150	0.103	157	0.073	0.067	429	0.085	0.066	144
Rural population rate	0.268	0.308	164	0.753	0.273	460	0.594	0.266	148
Poverty rate	0.299	0.201	163	0.607	0.221	459	0.506	0.216	146
Per capita income	4605.465	2789.437	164	2017.724	1208.440	460	2787.634	1470.583	148
Sum of monthly precipitation	99.949	168.199	164	468.709	184.087	468	894.895	407.002	152
Positive rainfall shock (≥0.75) (Yes=1)	0.238	0.427	164	0.145	0.353	468	0.191	0.394	152
Negative rainfall shock (≤-0.75) (Yes=1)	0.030	0.172	164	0.017	0.130	468	.	.	.
No rainfall shock (Yes=1)	0.732	0.444	164	0.838	0.369	468	0.809	0.394	152

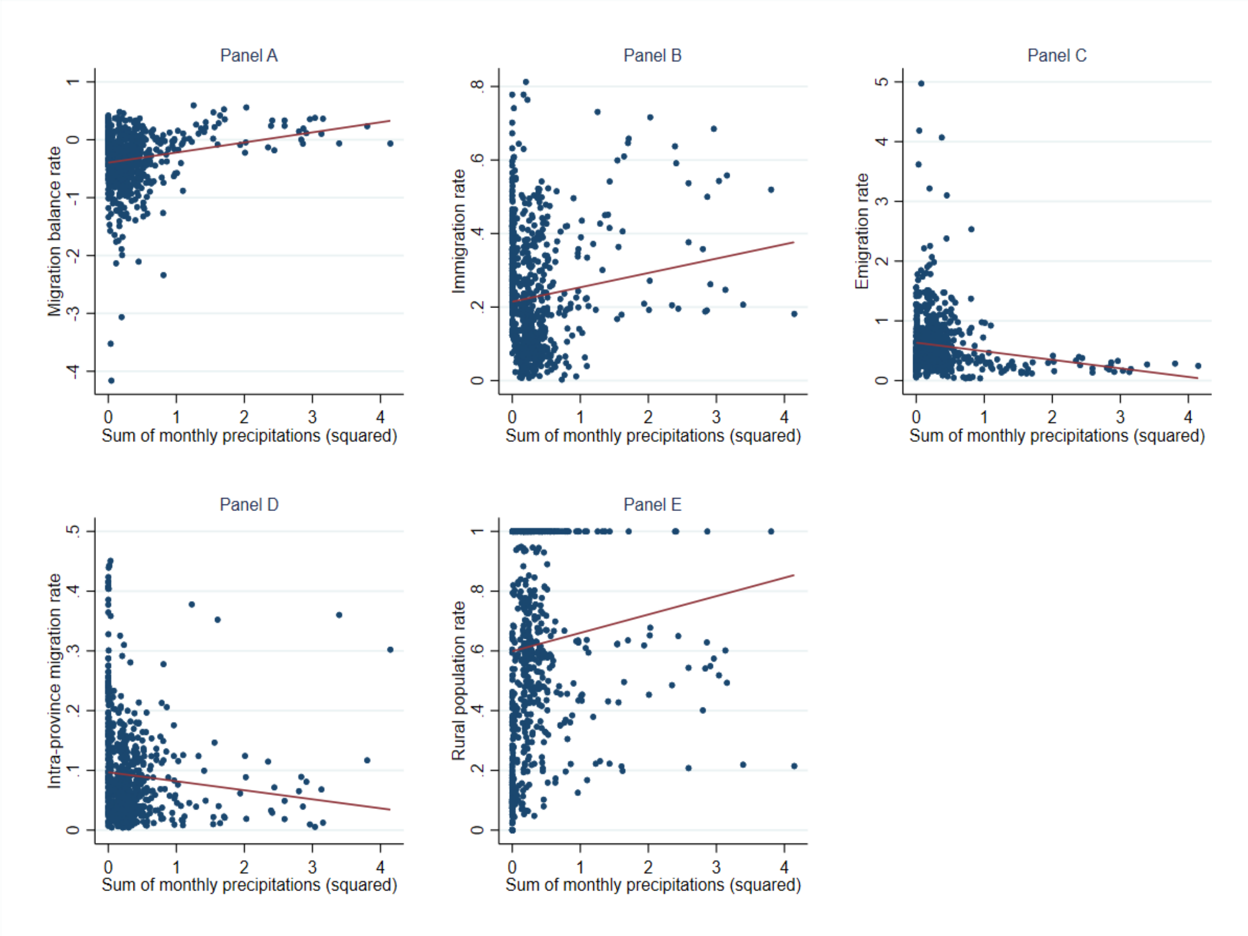
However, it is crucial to make a distinction between the amount of precipitation accumulated in a period and the existence of positive or negative rainfall shocks. Although it rains less in the coastal provinces compared to the highlands and the Amazon, this does not indicate that shocks cannot emerge. The exogeneity of rainfall is measured based on the magnitude of the deviation of a period's amount of rain with respect to its historical deviation, meaning that it is not an indicator of the severity or amount of accumulated rain. Thus, according to Table 4, nearly 24 percent of the coastal provinces presented a positive rainfall shock, and only 3 percent had a negative shock, while 73 percent of these provinces had precipitation within the normal values. In the case of the Andean region, close to 15 percent of the provinces had positive shocks, 2 percent presented negative shocks, and almost 84 percent did not present any rainfall shock. Finally, in the Amazon, no negative shocks occurred in any of the study years. This way, 19 percent of these provinces had positive shocks and 81 percent had neither positive nor negative shocks.

Figure 7: Sum of Monthly Precipitation by Geographic Region



To conclude this section, Figure 8 shows five panels (A-E) describing the relationship between the sum of monthly precipitation in a period and the migration patterns considered as dependent variables. Panel A shows a positive linear relationship between rainfall and the provinces' migration balance rate. From a descriptive and qualitative perspective, this would indicate that the migration balance rate increases in provinces where precipitation is more intense. However, it is not deeply understood whether this effect is driven by immigration, emigration, or both indicators jointly. This way, Panels B and C show that immigration follows a opposite trend regarding the emigration rate. While the former increases in provinces with greater rainfall, the latter presents a negative relationship. These results are narrowly linked with those presented in Panel A, indicating that the positive relationship between precipitation and the migration balance rate is driven by both effects. Also, Panel D shows a negative relationship between precipitation and within-province migration. That is, the intra-province migration rate decreases with higher amounts of rainfall. Finally, Panel E shows that the rural population rate increases with rainfall. This way, the share of the provinces' rural population is considered as a proxy for rural-to-urban migration, and greater (less) immigration (emigration) may be occurring from these areas whenever precipitation increases.

Figure 8: The Relationship Between Precipitation and Internal Migration Patterns



It is important to highlight some considerations regarding these results. Firstly, the summary statistics presented are merely descriptive and the depicted trends do not necessarily imply the existence of statistical significance. However, this analysis can provide some insights for the improvement of the econometric models' specification, in order to obtain more robust results, and to outline some hypotheses about the underlying mechanisms behind these relationships. Secondly, some of the statistics exhibited, mainly those shown in Figure 7, are referential and represent a simplification of a more complex reality. In this way, for instance, the positive relationship between rainfall and the migration balance rate may indicate that precipitation does not represent a hazard or are not essentially negative for individuals, since the immigration rate follows a positive relationship, and the emigration rate an opposite one. However, this linear pattern does not capture the potential adverse effects of positive -or negative- rainfall shocks, or situations in which rainfall becomes severe enough to cause devastating effects, such as losses in agricultural production, landslides, or floods.

In this sense, precipitation can be beneficial in many aspects, especially in Peru, where agriculture is heavily dependent on rainfall. But some of its adverse effects are not captured by this linear relationship. Finally, it is important to consider that a descriptive analysis does not allow the identification of confounding variables intervening in the relationship. Such an evaluation may be subject to spurious associations. Thus, for example, immigration to localities where greater rainfall occur may be determined by the "pulling" force of the provinces of the Amazon during this period, which is, in turn, the region with a larger average of monthly precipitation. Therefore, it is crucial to consider province fixed effects, which capture the unobservable and time-invariant particularities in each locality that may be driving this relationship. These considerations will be implemented in the following section.

VIII. Results:

This section shows the results based on the specifications outlined above. It is divided into four segments. The first part exhibits the estimates from the fixed effects regressions for the full sample, so a pooled ordinary least squares (OLS) technique was performed for the stacked provinces. Likewise, the estimates from the same specification are obtained after splitting the sample into provinces from the coast, the highlands, and the Amazon, such that the same regressions are performed for each geographic region. The second part presents a robustness test by performing an instrumental variable regression to ensure the reliability of the pooled OLS results. The third part explores the unexpected nature of precipitation after adding a dummy variable that captures the presence of negative and positive shocks in the main specification. In this way, four cut-off points are independently analyzed and contrasted to identify heterogeneities. Then, the potential differences between negative and positive shocks are explored using the cut-off point of 0.75 (-0.75) and 0.9 (-0.9) standard deviations. Finally, the fourth part investigates possible mechanisms by which rainfall and its shocks would affect migration patterns in Peru. Particularly, the effects of precipitation-related natural disasters are explored.

VIII.1. The Effect of Precipitation on Migration Patterns: Pooled Ordinary Least Squares with Province Fixed Effects:

Table 5 shows the estimates measuring the effect of rainfall on inter-province migration, which is decomposed into the migration balance rate and the immigration and emigration rates. In general terms, it is observed that all specifications improve their goodness of fit when the province fixed effects are included. Equations 1.1, 1.3, and 1.5 do not consider these dummies, while the rest do. Furthermore, both the statistical significance and the magnitude of the effects vary considerably when including the fixed effects. This way, precision improves and omitted variable bias issues are attenuated.

Thus, in specification 1.2 it is observed that none of the variables have a significant effect on the inter-province migration balance rate. Although precipitation has a negative quadratic relationship with this outcome variable, the effect is not significant. However, equation 1.4 also shows a negative quadratic relationship between rainfall and the immigration rate. In this way, it is observed that the effect of rainfall on the inter-province immigration rate is not constant, and that it varies as a function of the amount of precipitation occurred.

Thus, from a qualitative perspective, this relationship has an inverted "U" shape. In other words, the immigration rate is lower in provinces that present less rainfall and where there are extreme precipitation events. Conversely, the immigration rate increases in provinces with relatively moderate rainfall. Based on the estimated parameters, the immigration rate-rainfall relationship curve reaches its peak when the sum of the monthly precipitation equals 1,070 millimeters. This way, below this critical point, precipitation and the immigration rate are positively related, whereas it becomes negative once this threshold is surpassed. It is presumed that this effect is mainly determined by the "pulling" force of the provinces of the Amazon since 65 percent of the observations whose precipitation was one standard deviation below and above this critical point were from this geographic region.

Finally, specification 1.6 shows that rainfall does not have a significant effect on the inter-province emigration rate. It is important to note that the effect of precipitation on the immigration rate is not strong enough to generate a large impact on the migration balance rate, which is why the effect is not significant.

Table 5: The Effect of Precipitation on Inter-Province Migration – Pooled Ordinary Least Squares Estimations

	Migration balance rate		Immigration rate		Emigration rate	
	1.1	1.2	1.3	1.4	1.5	1.6
Year (2007=1)	0.019 (0.040)	-0.008 (0.024)	0.059*** (0.012)	0.013** (0.006)	0.021 (0.041)	0.028 (0.028)
Year (2008=1)	0.023 (0.038)	0.007 (0.019)	0.031*** (0.012)	0.004 (0.004)	0.008 (0.043)	0.011 (0.025)
Year (2009=1)	0.012 (0.036)	0.008 (0.017)	0.018 (0.011)	-0.001 (0.004)	0.004 (0.040)	-0.004 (0.018)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	0.077 (0.108)	-0.027 (0.125)	-0.213*** (0.031)	-0.016 (0.026)	-0.196 (0.126)	-0.085 (0.171)
Per capita income/100	0.000 (0.001)	-0.001 (0.002)	0.002*** (0.000)	0.000 (0.000)	0.002 (0.001)	0.001 (0.002)
Rural population rate	-0.894*** (0.070)	-0.287 (0.208)	-0.059*** (0.021)	-0.070 (0.082)	0.872*** (0.069)	0.229 (0.223)
Sum of monthly precipitation/1,000	0.188 (0.120)	0.074 (0.133)	-0.026 (0.046)	0.055** (0.026)	-0.281*** (0.109)	-0.015 (0.151)
Sum of monthly precipitation/1,000 (Squared)	0.107 (0.085)	-0.008 (0.057)	0.073** (0.034)	-0.025* (0.014)	-0.007 (0.059)	-0.024 (0.063)
Province fixed effects	NO	YES	NO	YES	NO	YES
Number of observations	***758***	***758***	***758***	***758***	***768***	***768***
R-Squared	***0.386***	***0.927***	***0.494***	***0.955***	***0.264***	***0.892***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

On the other hand, Table 6 shows the effect of rainfall on the intra-province migration rate, that is, the sum of all migratory movements within a province. Specification 1.7 shows the estimates of the equation without considering the province dummies. In this case, a positive quadratic relationship is observed between precipitation and the intra-province migration rate. However, the parameters lose statistical significance after including the fixed effects in equation 1.8. This indicates that this migration pattern is driven by some unobservable or time-invariant province's characteristics, since, on the other hand, the specification improves its goodness of fit in this last equation. Similarly, it is observed that the quadratic relationship remains positive, although not significant.

Table 6: The Effect of Precipitation on Intra-Province Migration – Pooled Ordinary Least Squares Estimations

	Intra-province migration rate	
	1.7	**1.8**
Year (2007=1)	0.003 (0.007)	0.001 (0.004)
Year (2008=1)	0.001 (0.007)	0.000 (0.003)
Year (2009=1)	0.001 (0.007)	-0.000 (0.003)
Year (2010=1)	(Omitted)	(Omitted)
Poverty rate	-0.047*** (0.016)	-0.024 (0.018)
Per capita income/100	-0.000 (0.000)	-0.000 (0.000)
Rural population rate	-0.094*** (0.010)	-0.031 (0.053)
Sum of monthly precipitation/1,000	-0.075*** (0.025)	-0.002 (0.021)
Sum of monthly precipitation/1,000 (Squared)	0.038** (0.017)	0.004 (0.013)
Province fixed effects	NO	YES
Number of observations	***729***	***729***
R-Squared	***0.318***	***0.929***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

Table 7 shows the parameters obtained for the rural population rate as "proxy" of the rural-to-urban migration pattern. Like the results in Table 6, the effect of rainfall on the rural population rate exhibited in equation 1.9 loses significance in 1.10, where the former does not include the province fixed effect, and the latter does. In principle, there is a progressive reduction in the rural population over time. According to the results from column 1.10, the rural population rate was 1.3 percentage points higher in 2007, 0.9 percentage points higher in 2008, and 0.5 percentage points higher in 2009, compared to 2010, which is the reference base year. This way, in the case of the year fixed effects parameters of 2007 and 2008, it is observed that they are statistically significant at the 99% level, while in 2009, the significance is 95%. Regarding precipitation, 1.9 shows the quadratic and negative relationship between the regressor of interest and the rural population rate. This way, the rural population rate is lower in the localities where there is very little or excessive rainfall. Nevertheless, this effect is null after including the province fixed effects, although the relationship remains quadratic and negative. As in most of the previous specifications, the loss of statistical significance after including these fixed effects indicates that the provinces' characteristics are the key drivers of rural population rate changes over time.

Table 7: The Effect of Precipitation on the Rural Population Rate – Pooled Ordinary Least Squares Estimations

	Rural population rate	
	1.9	**1.10**
Year (2007=1)	-0.088*** (0.025)	0.013*** (0.003)
Year (2008=1)	-0.046* (0.025)	0.009*** (0.002)
Year (2009=1)	-0.042* (0.024)	0.005** (0.002)
Year (2010=1)	(Omitted)	(Omitted)
Poverty rate	0.697*** (0.105)	0.002 (0.011)
Per capita income/100	-0.003 (0.002)	-0.000 (0.000)
Sum of monthly precipitation/1,000	0.329*** (0.077)	0.006 (0.012)
Sum of monthly precipitation/1,000 (Squared)	-0.177*** (0.048)	-0.004 (0.007)
Province fixed effects	NO	YES
Number of observations	***768***	***768***
R-Squared	***0.509***	***0.632***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

However, it is important to highlight a crucial consideration regarding the present analysis, which is linked to the fact that considering the rural population rate as a "proxy" for rural-to-urban migration patterns does not enable the comprehension of the mechanisms behind this relationship. In this sense, it may be more pertinent to decompose this indicator, as in the case of inter-province migration, into immigration and emigration rates. In this way, it would be possible to identify the channels through which rainfall affects the rural population rate. The literature has documented that rural areas tend to have higher emigration rates, and there are not necessarily immigration patterns towards these localities, which is why, on average, the rural population would progressively decrease over time. Nevertheless, rural areas with more rainfall may have lower emigration rates than localities with scarce precipitation. This limitation should be considered in future investigations.

The results of the presented specifications are still general and are related to migration patterns at the level of all the provinces that comprise the Peruvian territory. However, as noted in the descriptive section, there are heterogeneous processes depending on the geographic region in which a province is located. In this way, the same analysis is conducted taking each geographic region as a reference. That is, the migration patterns are assessed independently for the provinces of the coast, the highlands, and the Amazon.

Table 8 depicts the results of the parameters obtained for the coastal provinces. All the specifications include the province fixed effects. Equation 1.11 shows that rainfall does not affect the migration balance rate. Moreover, unlike the results in Table 5, where immigration is affected by precipitation, this pattern does not show in the coastal region, as shown in column 1.12. Specifications 1.14 and 1.15 show similar results. Both the intra-province migration rate and the rural population rate are not affected by rainfall since in both equations the relationship is not statistically significant. However, the equation 1.13 exhibits a significant quadratic and positive relationship between rainfall and the emigration rate in the coast.

After analyzing the linear and quadratic coefficients jointly, it is observed that the critical point occurs when precipitation reaches 614 millimeters. Before this point, the emigration rate remains relatively low, and is negatively related to rainfall. On the contrary, when rainfall exceeds this point, emigration kicks in and it increases progressively at a faster rate. It is important to note that this value is abruptly higher than the average rainfall in the coast, which is 99 millimeters. It is possible that the emigration rate increases after this threshold since rainfall is comparatively more severe in these provinces in relation to the coastal average. Likewise, it is observed that all the provinces that exceed this critical point are located in the northern coast, where rainfall's negative impacts tend to be more concentrated.

Table 8: The Effect of Precipitation on Internal Migration Patterns (Coast Provinces) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	1.11	**1.12**	**1.13**	**1.14**	**1.15**
Year (2007=1)	0.062 (0.040)	0.019 (0.012)	-0.043 (0.040)	0.007 (0.009)	0.004 (0.006)
Year (2008=1)	0.026 (0.031)	0.014 (0.010)	-0.012 (0.029)	0.004 (0.007)	0.007 (0.005)
Year (2009=1)	-0.003 (0.027)	-0.009 (0.010)	-0.006 (0.026)	0.000 (0.006)	0.004 (0.004)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	-0.277 (0.264)	-0.031 (0.094)	0.246 (0.218)	-0.037 (0.059)	0.016 (0.026)

Per capita income/100	-0.001 (0.002)	0.001 (0.001)	0.001 (0.001)	-0.000 (0.000)	-0.000 (0.000)
Rural population rate	-0.070 (0.561)	0.022 (0.320)	0.092 (0.450)	0.134 (0.170)	.
Sum of monthly precipitation/1,000	0.538 (0.354)	0.089 (0.146)	-0.449 (0.291)	0.018 (0.090)	-0.063 (0.046)
Sum of monthly precipitation/1,000 (Squared)	-0.690 (0.325)	-0.095 (0.117)	0.594** (0.263)	-0.011 (0.090)	0.039 (0.032)
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***163***	***163***	***163***	***156***	***163***
R-Squared	***0.902***	***0.928***	***0.911***	***0.950***	***0.998***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

Table 9 presents the results of the main specification for the provinces located in the highlands. In general, it is not observed a relationship between rainfall and internal migration patterns since the coefficients of the regressor variables of interest are not statistically significant in all the equations. However, some results are of special interest. Firstly, as depicted in column 1.17, the immigration rate is higher in those provinces with a lower rural population rate. Specifically, a 10 percentage-point increase in rurality is associated with a decrease in the immigration rate of nearly 2 percentage points. This would imply that provinces from the highlands that tend to "pull" population from other provinces are those where greater demographic changes had taken place, where urbanization processes have developed more strongly. Secondly, the rural population has been decreasing throughout these years, as shown in equation 1.20, a result that contrasts with those from the coast. Thus, in 2007 the rural population rate was 1.3 percentage points higher than in 2010, while in 2008, 1 percentage point higher, and 0.7 percentage points in 2009.

Table 9: The Effect of Precipitation on Internal Migration Patterns (Highlands Provinces) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	1.16	**1.17**	**1.18**	**1.19**	**1.20**
Year (2007=1)	-0.026 (0.037)	0.005 (0.007)	0.041 (0.044)	-0.000 (0.005)	0.013*** (0.004)
Year (2008=1)	0.013 (0.028)	-0.002 (0.006)	0.009 (0.039)	-0.001 (0.004)	0.010*** (0.003)
Year (2009=1)	0.012 (0.025)	-0.001 (0.005)	-0.005 (0.027)	-0.000 (0.004)	0.007** (0.003)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	-0.027 (0.174)	-0.004 (0.029)	-0.123 (0.247)	-0.024 (0.023)	0.011 (0.013)

Per capita income/100	-0.002 (0.004)	-0.000 (0.001)	0.001 (0.004)	0.000 (0.000)	-0.000 (0.013)
Rural population rate	-0.220 (0.264)	-0.187** (0.089)	0.060 (0.295)	-0.071 (0.068)	.
Sum of monthly precipitation/1,000	-0.177 (0.256)	-0.031 (0.052)	0.219 (0.285)	0.008 (0.039)	-0.007 (0.019)
Sum of monthly precipitation/1,000 (Squared)	0.257 (0.221)	0.055 (0.051)	-0.273 (0.230)	-0.008 (0.033)	0.008 (0.015)
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***449***	***449***	***459***	***429***	***459***
R-Squared	***0.899***	***0.921***	***0.871***	***0.892***	***0.995***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

The results for the Amazon provinces are presented in Table 10. Equations 1.21 to 1.24 show that the relationship between precipitation and the migration patterns assessed in these specifications is null. Yet, there is greater immigration towards provinces that are predominantly rural, as shown in equation 1.22. In this way, the hypothesis that gives sense to the results in Table 5 seems to be confirmed. Given that rainfall is greater in the Amazon compared to the rest of the geographic regions, the significant relationship between the immigration rate and rainfall may be driven by the results in equation 1.22. In this sense, a 10-percentage point in the rural population rate is related to a 3-percentage point increase in the immigration rate in provinces of the Amazon. However, equation 1.23 shows that emigration is also predominantly higher in rural areas. Thus, an increase of 10 percentage points in the rural population rate is related to an increase of almost 8 percentage points in the emigration rate. The net effect presented in equation 1.21 is negative although not significant. In this sense, predominantly rural provinces in the jungle are regarded as "pulling" and "pushing" localities.

Finally, as equation 1.25 shows, the rural population rate is greater in localities where it rains the most. The quadratic term of precipitation is not statistically significant, while the linear term shows a positive and significant parameter. Thus, an increase of 1,000 millimeters of precipitation is linked to a 6-percentage point increase in the rural population rate. This way, it is crucial to clarify an important issue regarding this finding. It might be intuited that this relationship is merely coincidental and arguing that more precipitation occurs in rural areas. Nonetheless, this argument is not plausible since rainfall is homogeneously distributed both in rural and urban areas of the Amazon. In this sense, there is a weak and negative correlation between rainfall and the rural population rate in this geographic area. This would imply that precipitation does represent an important factor in people's decision to migrate in these localities.

Table 10: The Effect of Precipitation on Internal Migration Patterns (Amazon Provinces) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	1.21	1.22	1.23	1.24	1.25
Year (2007=1)	-0.012 (0.039)	0.025** (0.011)	0.037 (0.035)	-0.000 (0.008)	0.024*** (0.007)
Year (2008=1)	-0.015 (0.033)	0.012 (0.008)	0.028 (0.031)	-0.001 (0.007)	0.008 (0.005)
Year (2009=1)	0.017 (0.024)	0.011 (0.008)	-0.006 (0.022)	-0.001 (0.006)	0.002 (0.005)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	0.185 (0.144)	-0.006 (0.051)	-0.191 (0.133)	0.006 (0.041)	-0.050* (0.027)
Per capita income/100	-0.001 (0.003)	0.001 (0.001)	0.002 (0.003)	0.000 (0.001)	-0.000 (0.001)
Rural population rate	-0.478 (0.455)	0.290* (0.162)	0.768* (0.449)	0.049 (0.083)	.
Sum of monthly precipitation/1,000	0.026 (0.210)	0.038 (0.073)	0.012 (0.179)	-0.011 (0.072)	0.063* (0.037)
Sum of monthly precipitation/1,000 (Squared)	0.005 (0.077)	-0.020 (0.030)	-0.026 (0.066)	0.009 (0.031)	-0.025 (0.015)
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***146***	***146***	***146***	***144***	***146***
R-Squared	***0.909***	***0.965***	***0.885***	***0.915***	***0.995***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

VIII.2. Robustness Test: Assessing the Validity of the Pooled OLS Results:

This section presents the results of the instrumental variable regression defined in the equations exhibited in the methodological segment. The objective of instrumenting the rainfall variable, which measures the reported values from a province's capital one or two closest grids, through a variable that measures the precipitation values recorded in the third or fourth closest grid is to mitigate potential measurement errors. This methodology is applied by Manccini and Yang (2009) in a study focused on estimating the impacts of early-life exposure to rainfall shocks on health, education, and socioeconomic adulthood outcomes in Indonesia. This study includes the same strategy, and the results are contrasted with the estimates in the previous section. The logic of considering this variable as an instrument is that it is objectively relevant since it correlates with rainfall values from the closest grids to the center of the province. Likewise, it is presumed that precipitation in farther areas do not directly affect the internal migration patterns in these localities; that is, it is likely that the exclusion restriction holds. Table 11 depicts the instrumental variable regressions for each migration indicator, where the parameters were estimated with the two-stage least squares method[15].

Table 11: The Effect of Precipitation on Internal Migration Patterns – Two Stage Least Squares (2SLS) Estimations

	Migration balance rate	**Immigration rate**	**Emigration rate**	**Intra-province migration rate**	**Rural population rate**
	2.1	**2.2**	**2.3**	**2.4**	**2.5**
Year (2007=1)	-0.008 (0.024)	0.014** (0.005)	0.028 (0.028)	0.001 (0.004)	0.013*** (0.003)
Year (2008=1)	0.007 (0.019)	0.004 (0.004)	0.011 (0.025)	0.000 (0.003)	0.009*** (0.002)
Year (2009=1)	0.009 (0.017)	-0.001 (0.004)	-0.004 (0.018)	-0.000 (0.003)	0.005** (0.002)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	-0.026 (0.125)	-0.014 (0.026)	-0.084 (0.173)	-0.025 (0.018)	0.002 (0.011)
Per capita income/100	-0.001 (0.002)	0.000 (0.000)	0.001 (0.002)	-0.000 (0.000)	-0.000 (0.000)
Sum of monthly precipitation/1,000 (Predicted)	0.040 (0.129)	0.040 (0.027)	-0.007 (0.138)	-0.007 (0.020)	0.000 (0.012)
Sum of monthly precipitation/1,000 (Squared) (Predicted)	0.018 (0.053)	-0.012 (0.014)	-0.028 (0.055)	0.004 (0.012)	-0.000 (0.007)
Rural population rate	-0.287 (0.208)	-0.068 (0.082)	0.231 (0.224)	-0.031 (0.053)	.
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***758***	***758***	***768***	***729***	***768***
R-Squared	***0.927***	***0.955***	***0.892***	***0.929***	***0.997***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

Thus, the obtained parameters from the instrumental variable regression differ significantly from those estimated in Tables 5 to 7. Table 11 shows that precipitation does not affect any of the migration indicators. Moreover, it is noted that the immigration rate is no longer related to rainfall, as shown in equation 2.2. The linear and the quadratic coefficients of the predicted precipitation variable are not statistically significant and had remarkable changes in their magnitudes, compared to equation 1.4. Thus, regardless of the significance, after jointly assessing the parameters of both variables, a widely different critical point is obtained when compared to the OLS results. The instrumental variable regression derives a 182 millimeters

[15] Appendix 7 shows the instrumental variable regression first stage results.

threshold, which is abruptly lower than the 1,070 millimeters threshold obtained from equation 1.4.

This way, it is possible to outline a series of hypotheses regarding the discrepancy between the results in specification 1.4 and 2.2. Firstly, the presence of measurement error in the instrument can be presumed. Moreover, if the measurement errors are systematic -and not random-, then it would be possible to infer that the instrument correlates with the error term of the structural equation. Secondly, although it has been identified that there is a strong correlation between the instrument and the rainfall values of the provinces, it remains possible that it is still a weak or unsuitable instrument, since the center of the province and the third/fourth closest grid considered may be widely separated from each other, so that precipitation from both locations may be relatively dissimilar. Hence, when instrumenting the regressor variable of interest with rainfall from a distant location, the yielded estimators can be biased, even if there were no measurement errors. However, the present analysis neither confirms nor denies the validity of the OLS results, and they must be regarded only as a robustness test.

VIII.3. Exploring the Unexpected Nature of Rainfall:

This part studies the unexpected nature of precipitation and its effects on migration patterns in Peru. As mentioned before, a rainfall shock is defined when the difference between a rainfall value in a specific province, month, and period, and the historical mean from 1961 to 2010 in the same month deviates (positively and negatively) from the same years' standard deviation in a defined magnitude. This way, four cut-off points were established for this purpose and were included in the main specification as dummy variables. The cut-off points are 0.5 (-0.5), 0.6 (-0.6), 0.75 (-0.75), and 0.9 (-0.9) standard deviations from the historical dispersion. Hence, these dummy variables were separately considered in the main equation to assess heterogeneous effects on internal migration patterns as a function of the magnitude of these shocks. Also, the linear and the quadratic terms of the sum of the monthly precipitation were also included since the amount of precipitation is not necessarily related to the presence of a rainfall shock.

Table 12 summarizes the results of the main specification after including the rainfall shock-related dummies. Equations from columns 3.1 and 3.2 include the dummy variables for the cut-off points of 0.5 (-0.5) and 0.6 (-0.6) respectively. In both columns, the rainfall shock dummies are not statistically significant in any of the outcome variables. However, in columns 3.3 and 3.4, the shock-related dummies become significant in some of the regressed variables. This may indicate that from the 0.75 (-0.75) threshold, the effects become more visible. In the case of column 3.3, the presence of a rainfall shock is related to a 1.1-percentage point increase in the immigration rate, as well as an increase of 0.4 percentage points in the rural population rate. In contrast, in column 3.4, a rainfall shock of a magnitude of 0.9 (-0.9) standard deviations also increases the immigration rate in 0.9 percentage points. This implies that this increase is lower in magnitude than in the case of column 3.3. Likewise, the rural population rate also increases in 0.4 percentage points when a rainfall shock of this magnitude occurs.

Table 12: The Effect of Rainfall Shocks on Internal Migration Patterns – Pooled Ordinary Least Squares Estimations

	Rainfall Shock (±0.5)	Rainfall Shock (±0.6)	Rainfall Shock (±0.75)	Rainfall Shock (±0.9)	*Number of observations*
	3.1	**3.2**	**3.3**	**3.4**	
Migration balance rate	0.001 (0.013)	0.005 (0.018)	0.006 (0.018)	-0.002 (0.022)	***758***
Immigration rate	0.004 (0.004)	-0.000 (0.004)	0.011** (0.005)	0.009* (0.005)	***758***
Emigration rate	-0.019 (0.018)	-0.016 (0.018)	-0.005 (0.023)	-0.001 (0.027)	***768***
Intra-province migration rate	-0.001 (0.003)	-0.003 (0.003)	-0.003 (0.003)	-0.000 (0.004)	***729***
Rural population rate	0.001 (0.002)	0.002 (0.002)	0.004* (0.002)	0.004** (0.002)	***768***
Year FE:	YES	YES	YES	YES	
Controls:	YES	YES	YES	YES	
Province FE:	YES	YES	YES	YES	

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

Thus, it is possible to argue that rainfall shocks are not essentially hazardous or bad for people. However, to have a more exhaustive understanding of these findings, the unexpected nature of precipitation is exploited by differentiating between positive and negative rainfall shocks. Hence, Table 13 summarizes the obtained parameters after including these dummy variables. Like the results in Table 5, precipitation has a null effect on the migration balance rate, de emigration rate, the intra-province migration rate, and the rural population rate, as equations 3.5, 3.7, 3.8, and 3.9 show. Nevertheless, specification 3.6 confirms that the immigration rate is the only migration pattern affected by rainfall. The magnitudes of the coefficients remain relatively stable, as well as the significance, and the negative quadratic relationship. Likewise, after including the rainfall shocks-related dummies, it is observed that immigration increases in the presence of negative shocks. Specifically, it increases in 3 percentage points compared to the provinces that are not affected by any rainfall shock. The same analysis was performed for the 0.9 (-0.9) cut-off point, in which the negative shock-related dummy loses statistical significance. This indicates that, as the negative shock increases in magnitude, its effect on the immigration rate is null[16].

[16] Appendix 8 shows the results for the 0.9 cut-off point.

Table 13: The Effect of Positive and Negative Rainfall Shocks on Internal Migration Patterns (±0.75 Standard Deviations) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	3.5	3.6	3.7	3.8	3.9
Year (2007=1)	-0.007 (0.024)	0.015*** (0.006)	0.028 (0.028)	0.001 (0.004)	0.014*** (0.003)
Year (2008=1)	0.008 (0.019)	0.006 (0.004)	0.012 (0.025)	0.000 (0.003)	0.009*** (0.002)
Year (2009=1)	0.009 (0.018)	-0.000 (0.004)	-0.002 (0.019)	0.000 (0.003)	0.005** (0.002)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	-0.026 (0.125)	-0.015 (0.026)	-0.085 (0.171)	-0.024 (0.018)	0.002 (0.011)
Per capita income/100	-0.001 (0.002)	0.000 (0.000)	0.001 (0.002)	-0.000 (0.000)	-0.000 (0.000)
Rural population rate	-0.292 (0.210)	-0.079 (0.082)	0.233 (0.227)	-0.028 (0.053)	.
Positive rainfall shock (≥0.75) (Yes=1)	0.004 (0.021)	0.007 (0.005)	-0.010 (0.027)	-0.004 (0.004)	0.004 (0.002)
Negative rainfall shock (≤-0.75) (Yes=1)	0.017 (0.032)	0.030* (0.017)	0.017 (0.038)	0.002 (0.006)	0.004 (0.006)
No rainfall shock (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Sum of monthly precipitation/1,000	0.072 (0.142)	0.050* (0.027)	0.004 (0.175)	0.004 (0.023)	0.001 (0.012)
Sum of monthly precipitation/1,000 (Squared)	-0.009 (0.058)	-0.027** (0.013)	-0.026 (0.064)	0.004 (0.013)	-0.004 (0.007)
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***758***	***758***	***768***	***729***	***768***
R-Squared	***0.927***	***0.956***	***0.892***	***0.929***	***0.997***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

Based on these results, it is presumed that the provinces that have moderate rainfall events "pull" more population compared to those localities where it rains to a lesser extent and excessively. However, the immigration rate increases in the absence of positive rainfall shocks, and moreover whenever there is a negative shock. At first glance, these results seem counterintuitive. Still, it is logical that people do not migrate towards provinces where it rains anomalously above the historical trend, since, as detailed in the following part, positive rainfall shocks are closely linked to the presence of some natural disasters. Likewise, it is not rational for people to move to places where it rains excessively -although this does not imply the existence of a rainfall shock. In a similar fashion, excessive rain is related to adverse events, such as the loss of agricultural areas. In sum, the provinces that present a negative rainfall shock, but where it still rains moderately, are the ones that tend to attract more people to their localities.

VIII.4. The Effects of Rainfall-Related Natural Disasters on Internal Migration Patterns:

This part explores the relationship between internal migration patterns in Peru and the presence of rainfall-related natural disasters/adverse shocks. Specifically, it scouts the effects of landslides, floods, and the loss/damage of agricultural areas on population mobility. To do so, open data from the National Institute of Civil Defense of Peru (INDECI) is used, where records of emergencies, natural disasters, and catastrophes are available at a monthly and province basis[17].

Table 14 displays the relationship between rainfall, the presence of positive or negative rainfall shocks, and the occurrence of natural disasters, measured as dummy variables. This way if a disaster happens, the variable takes the value of one, and zero otherwise. Although INDECI offers information on the number of these incidents, the use of dummy variables allows for a better and easier interpretation. Thus, equations 4.1 to 4.6 are linear probability models, in which the parameters were obtained using a simple OLS technique. Likewise, the coefficients were estimated with and without province fixed effects to identify biases. Finally, year fixed effects and controls were incorporated in all the specifications. The rationale for including controls lies in the fact that the effect of these disasters can be mitigated -or enhanced- based on the provinces' characteristics. For instance, a province with higher poverty rate may have a greater propensity to suffer the ravages of these events to a greater extent. In this sense, in the specifications that disregard the province fixed effects, precipitation is significantly related to the occurrence of the disasters. But, after including the province-related dummies, precipitation loses significance in some of the equations. In this way, the incidence of these emergencies may be primarily related to the provinces' characteristics -such as its response capacity or the level of public expenditure- rather than the amount of precipitation or the presence of rainfall shocks.

Thus, equation 4.2 shows that the occurrence of landslides is mainly linked to the existence of positive rainfall shocks. The provinces that have negative shocks are 27 percentage points less likely to have landslides, whereas the probability of occurrence of this disaster is 12 percentage points less in provinces where no shocks occurred, both compared to provinces where positive rainfall shocks take place. Still, the incidence of landslides is not related to the amount of precipitation in the locality. As a hypothesis, this could be related to the fact that there is a high proportion of landslides in locations with lesser amounts of precipitation, such as the provinces of the coast. The accumulation of rain in higher elevation areas can cause an increase in river flow and eventually overflow with severe impacts in lower altitude locations.

On the other hand, there is a strong relationship between the incidence of landslides and floods, as shown in equations 4.2 and 4.4. Thus, as depicted in equation 4.4, the occurrence of landslides increases the incidence of floods by 11 percentage points. Finally, equations 4.6 and 4.8 estimate the relationship between precipitation, rainfall shocks incidence, and the

[17] Appendix 9 shows the natural disasters and emergencies summary statistics for the full sample. Appendix 10 shows the same results by geographic region.

loss/damage of agricultural-intended areas. The former specification estimates the probability of occurrence, while the latter is measured as a continuous variable (thousands of hectares). Hence, the probability of farmland being loss/affected increases with the presence of positive rainfall shocks. In provinces with negative shocks, the probability decreases by 20 percentage points, and by 11 percentage points in localities where no shocks occur, both in relation to provinces with positive shocks. Finally, column 4.8 shows a positive and significant relationship between the amount of precipitation and the number of farmland hectares loss/affected. This way, a 1,000-millimeter increase of precipitation during the rainy season is linked to a loss/damage of almost 400 hectares of agricultural area.

Table 14: The Effect of Precipitation, and Positive and Negative Rainfall Shocks on Natural Disaster Events – Linear Probability Model

	Landslides (Yes=1)		**Floods (Yes=1)**		**Agricultural Area Affected (Yes=1)**		**Agricultural Area Affected (Continuous) / 1,000**	
	4.1	**4.2**	**4.3**	**4.4**	**4.5**	**4.6**	**4.7**	**4.8**
Sum of monthly precipitation/1,000	0.021 (0.053)	-0.223 (0.149)	0.424*** (0.051)	-0.000 (0.120)	-0.075* (0.043)	0.112 (0.123)	0.129 (0.129)	0.404* (0.232)
Positive rainfall shock (≥0.75) (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Negative rainfall shock (≤-0.75) (Yes=1)	-0.194** (0.091)	-0.265** (0.117)	0.196 (0.137)	-0.025 (0.138)	-0.070 (0.103)	-0.198* (0.123)	0.007 (0.103)	-0.662 (0.475)
No rainfall shock (Yes=1)	-0.043 (0.046)	-0.117** (0.055)	0.098** (0.044)	-0.069 (0.055)	-0.079* (0.042)	-0.106** (0.052)	0.097 (0.076)	-0.039 (0.075)
Floods (Yes=1)	0.220*** (0.037)	0.123*** (0.044)	.	.	0.177*** (0.037)	0.120** (0.048)	0.119 (0.094)	-0.014 (0.156)
Landslides (Yes=1)	.	.	0.222*** (0.038)	0.114*** (0.041)	0.035 (0.036)	0.018 (0.042)	-0.127* (0.069)	-0.052 (0.070)
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES	YES	YES	YES
Province fixed effects	NO	YES	NO	YES	NO	YES	NO	YES
Number of observations	***768***	***768***	***768***	***768***	***768***	***768***	***768***	***768***
R-Squared	***0.083***	***0.437***	***0.170***	***0.532***	***0.098***	***0.386***	***0.032***	***0.350***

Robust standard errors are in parenthesis
****p<0.01, **p<0.05, *p<0.1*

To conclude the present analysis, Table 15 displays the results of the main specification after adding the rainfall shocks-related dummies, and incidence of natural disasters. In this case, continuous measurements of the disasters were included instead of dummies. Overall, equations 4.9 to 4.13 show a null relationship between natural disasters and internal migration, since none of the variables measuring the incidence of these events are statistically significant. Still, both the precipitation's linear and quadratic terms remain statistically significant in equation 4.10. Hence, this specification confirms these findings. On the other hand, the negative rainfall shock dummy loses statistical significance when compared to equation 3.6 in Table 13. However, this may be related to an over-specification of the model since the goodness of fit remains constant. Appealing to the parsimony principle, it is intuited that specification 3.6 in Table 13 may be of greater validity.

Table 15: The Effect of Natural Disasters on Internal Migration Patterns – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	4.9	**4.10**	**4.11**	**4.12**	**4.13**
Sum of monthly precipitation/1,000	0.074 (0.143)	0.050* (0.027)	0.002 (0.176)	0.003 (0.022)	0.001 (0.012)
Sum of monthly precipitation/1,000 (Squared)	-0.010 (0.058)	-0.028** (0.013)	-0.025 (0.064)	0.004 (0.013)	-0.004 (0.007)
Positive rainfall shock (≥0.75) (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Negative rainfall shock (≤-0.75) (Yes=1)	0.011 (0.040)	0.023 (0.018)	0.028 (0.051)	0.007 (0.008)	0.001 (0.007)
No rainfall shock (Yes=1)	-0.004 (0.021)	-0.007 (0.005)	0.010 (0.028)	0.004 (0.004)	-0.004 (0.002)
Floods (Continuous)	-0.000 (0.002)	-0.000 (0.001)	0.000 (0.002)	0.001 (0.001)	-0.001 (0.001)
Landslides (Continuous)	0.001 (0.003)	-0.000 (0.001)	-0.000 (0.003)	0.000 (0.001)	0.000 (0.002)
Agricultural area affected (Continuous)	-0.003 (0.002)	-0.000 (0.001)	0.002 (0.002)	0.002 (0.001)	0.000 (0.002)
Year fixed effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***758***	***758***	***768***	***729***	***768***
R-Squared	***0.927***	***0.956***	***0.892***	***0.929***	***0.997***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

This analysis also investigates potential heterogeneities based on the geographic region in which the provinces are located. Therefore, the main specification's parameters were estimated for each of these regions separately[18]. In this way, after including the rainfall shocks-related dummies, as well as the incidence of disasters, a negative quadratic relationship between precipitation and the migration balance rate was found in provinces of the coast. That is, the migration balance rate increases with precipitation below the critical point value of 528 millimeters. Above this threshold, the relationship becomes negative. When decomposing this migration indicator, it is identified that the emigration rate performs as the mechanism by which the migration balance rate trend occurs, since the emigration-precipitation link is inverse and almost perfectly symmetrical. Specifically, the latter relationship is quadratic and positive, indicating that the migration balance rate increases at the same time emigration decreases. Once the critical value of 504 millimeters is reached, emigration starts to increase while rainfall increases too. Thus, the similarity between both thresholds would confirm the validity of these results.

Likewise, rainfall has a positive quadratic relationship with the rural population rate in coastal provinces. In this case, the precipitation critical value lies in 884 millimeters. These results show the differences regarding rainfall toleration in urban and rural coastal areas since in mainly rural provinces, rain is an essential resource for agricultural production. In contrast, rainfall can cause more severe negative impacts in urban localities. Moreover, contrary to what was expected, landslides negatively impact the emigration rate and positively impact the rural population rate, where each landslide causes a decrease of 1.5 percentage points and 0.7 percentage points respectively. Although these findings may be counterintuitive, it is possible to argue as a hypothesis that, in the presence of an emergency, emigration becomes more costly and less likely to occur depending on its destructive nature.

On the contrary, natural disasters are not related to inter-province migration patterns in the highlands. Nevertheless, the intra-province migration rate is sensitive to the increase in the number of lost/affected agricultural hectares. Hence, the migration rate within the province increases by 0.2 percentage points for every 1,000 hectares of farmland lost/affected. In this manner, small farmers may temporarily migrate to another district located within the same province to engage in other economic activities as a consequence of the loss of their crops. In other words, searching for temporary alternative employment may be presented as a coping mechanism due to an adverse shock in agricultural production This hypothetical relationship remains open for further investigation.

Finally, as described previously, the Amazon presents a significantly different migration pattern compared to the rest of the regions, since the immigration rate increases in highly rural provinces. After including the incidence of disasters in the model, the rural population rate coefficient remains statistically significant, and its magnitude stays unchanged after comparing these results with the ones from equation 1.22 in Table 10. Thus, the immigration rate increases by almost 3 percentage points for each 10-percentage point increase in the rurality rate. On the contrary, equation 1.23 in Table 10 showed that emigration is greater in highly rural areas. Nonetheless, when the disasters-related variables are incorporated, the rural population rate loses significance. In addition, the emigration rate increases by 1 percentage points for each 1,000 hectares of farmland loss/affected. That is, emigration from highly rural provinces may be conditional on the number of lost/affected crop areas.

[18] Appendices 11, 12, and 13 show the results by geographic region.

IX. Conclusions:

The previously presented results show that rainfall occurring during the rainy season affects the inter-province immigration rate for the period considered in this study. Specifically, rainfall has a significant quadratic and negative relationship with this migration indicator. From a graphical perspective, this relationship has the shape of an inverted "U". Thus, the immigration rate increases as the sum of monthly precipitation increases. Once the critical point of 1,070 millimeters is reached, the immigration rate decreases. This threshold is significantly higher than the average of the sum of the monthly precipitation for the full sample, which is 474 millimeters.

Likewise, by exploring the unexpected nature of precipitation, it is identified a significant effect on migration dynamics when rainfall is 0.75 (-0.75) standard deviations from its historical mean. There are no significant effects for the 0.5 (-0.5) and 0.6 (-0.6) values. This would indicate that the magnitude of these shocks is not strong enough to affect the migration patterns. Once the critical point of 0.75 (-0.75) is reached, the effects begin to kick-in, specifically in the immigration rate and the rural population rate. However, after distinguishing positive from negative shocks, the immigration rate increases by 3 percentage points in the provinces with negative shocks (less than -0.75 s.d.), compared to the provinces that did not experience any rainfall shock. In this sense, it is possible to infer that the localities where there is moderate rainfall -in terms of millimeters- but at the same time experience negative shocks -in terms of standard deviations-, are those that attract more people from other provinces to a greater extent. This is a plausible conclusion since positive shocks and precipitation are heavily related to the presence of landslides and the loss/damage of farmland. Still, after exploring the effect of rainfall-related natural disasters on internal migration patterns, it is observed that there is no statistically significant relationship between these indicators for the full sample.

However, when assessing geographic heterogeneities, it is identified differentiated effects by region. In this way, precipitation has a "pushing" effect in the coast when rainfall exceeds the critical value of 504-614 millimeters. That is, emigration increases above this point. These results seem plausible since it is presumed that the infrastructure in coastal provinces may not be adequate to support high levels of precipitation due to its arid nature, where rainfall does not occur frequently. In fact, most provinces that have precipitation amounts above this value are in the northern coast, where the effects of rainfall tend to be more devastating. On the other hand, landslides have a negative relationship with the emigration rate. Specifically, emigration decreases by 1.5 percentage points for each landslide. It is presumed that this negative relationship is given by the fact that, when a disaster occurs, relocation costs increase, such that emigration may not emerge as an adaptation strategy. This way, once the disaster occurs, emigration would be heavily restricted.

A significantly different migration pattern is identified in the Amazon, although not directly related to precipitation. The immigration rate increases by 3 percentage points for each 10-percentage point increase in rurality. This would imply that people move towards highly rural provinces in the Peruvian jungle. Moreover, the emigration rate increases by 1 percentage point for each loss/damage of 1,000 hectares of cropland. In this sense, it is possible that the overall relationship between the immigration rate and precipitation is being driven by immigration towards the Amazon. More specifically, to highly rural provinces. This since this geographic region experiences higher rainfall in relation to the rest of the regions.

However, it is not possible to argue that the relationship between immigration and precipitation is merely fortuitous. The fact that there is greater emigration from rural areas due to losses and damages of farmland may indicate that migration towards the Amazon is determined by the presence of economic activities related to agricultural production. More specifically, the production of water-intensive crops. Thus, in recent years, the Amazon has experienced the expansion of crops such as coffee, cacao, and palm oil, production that is oriented towards the international market. Nearly 50 percent of the Peruvian jungle's exports are destined to Europe. This makes the Amazon the most important agricultural area in Peru (von Hesse, 2023). One of the pending challenges for future investigations is to elucidate the impact of alternative cultivation programs conducted by the Peruvian State on different mobility patterns -possibly seasonal migration.

The differentiated effects of precipitation and rainfall shocks on internal migration patterns makes the formulation and rethinking of policies and strategies essential, especially considering geographic heterogeneities. While in the coast, excess rainfall represents a negative shock to urban infrastructure -and therefore, it may accelerate emigration processes- in the Amazon it is related to the loss/damage of cropland. In this way, strategies such as improving and investing in adequate infrastructure and the zoning of urban space could be more suitable in the context of the coast. In contrast, in the jungle, the expansion of agricultural insurance coverage could be of greater relevance.

To conclude, it is crucial to highlight that the results presented in this study are valid for the analysis period considered. The emergence of other events, contingencies, and external institutional, political, and economic shocks could alter the identified relationships. It is important to consider that the effects of climate change are not stable, but depend primarily on human action, and more specifically on the management and response capacity of governments. In this sense, exogenous or structural changes may affect the magnitude and significance of the parameters. Also, this study does not consider personal and individual attributes that would play a crucial role in migration decisions. Considering the provinces as observation units could hide other heterogeneities at the individual level that could strengthen the robustness of the analysis. Finally, it is not possible to indicate that changes in precipitation are based on anthropogenic climate variations. However, severe climate shocks may occur more frequently in the short and medium term, so it is highly likely that the effects on internal migration patterns will appear with greater intensity.

Bibliography:

Aguilar, A. and Vicarelli, M. (2011). "El Niño and Mexican children: medium-term effects of early-life weather shocks on cognitive and health outcomes", *World Development,* Elsevier, vol. 150(C).

Aldana, U. and Escobal, J. (2016). "Los efectos de la migración interna entre 2007 y 2014 en el Perú, un análisis a nivel provincial", *Serie Documentos de Trabajo N°203,* Programa Cohesión Territorial para el Desarrollo. Rimisp, Santiago de Chile.

Barrios, S., Bertinelli, L., and Strobl, E. (2006). "Climatic change and rural-urban migration: The case of sub-Saharan Africa", *Journal of Urban Economics,* vol. 60, pp. 357-371.

Beine, M. and Parsons, C. (2015). "Climatic Factors as Determinants of International Migration", *The Scandinavian Journal of Economics,* 117(2), pp. 723-767.

Bergmann J. et al. (2021). "Assessing the Evidence: Climate Change and Migration in Peru". Potsdam Institute for Climate Impact Research (PIK). Potsdam and International Organization for Migration (IOM), Geneva.

Borjas, G. (2014). *Immigration Economics*. Harvard University Press. Cambridge, Massachusetts.

Cameron, A.C and Trivedi, P.K. (2005). *Microeconometrics. Methods and Applications.* Cambridge University Press. Cambridge, UK.

Cashin, P., Mohaddes, K., and Raissi, M. (2017). "Fair weather or foul? The macroeconomic effects of El Niño", *Journal of International Economics,* 106(2017), pp. 37-54.

De Brauw, A. and Harigaya, T. (2007). "Seasonal Migration and Improving Living Standards in Vietnam", *American Journal of Agricultural Economics,* 89(2), pp. 430-447.

Díaz, J. and Saldarriaga, V. (2023). "A drop of love? Rainfall shocks and spousal abuse: Evidence from rural Peru", *Journal of Health Economics,* 89. May, 2023.

Harris, I. et al. (2020). "Version 4 of the CRU TS monthly high-resolution gridded multivariate climate dataset", *Scientific Data,* 7(109), pp. 1-18.

Hicks, J. (1963). *The Theory of Wages.* Palgrave Macmillan London.

Huarancca, M., Alanya, W., and Castellares, R. (2020). "La Migración Interna en el Perú, 2012-2017". Banco Central de Reserva del Perú. Serie Documentos de Trabajo N° 2020-007.

Instituto Nacional de Estadística e Informática del Perú (INEI) (2017). Censo Nacional de Población y Vivienda 2017.

Inter-American Development Bank (2015). "The Experience of Latin America and The Caribbean in Urbanization. Knowledge Sharing Forum on Development Experiences: Comparative Experiences of Korea and Latin America and The Caribbean". Discussion Paper N°IDB-DP-395. March 2015. Available at: https://publications.iadb.org/publications/english/viewer/The-Experience-of-Latin-America-and-the-Caribbean-in-Urbanization-Knowledge-Sharing-Forum-on-

Development-Experiences-Comparative-Experiences-of-Korea-and-Latin-America-and-the-Caribbean.pdf

Lattes, A. (1995). "Urbanización, Crecimiento Urbano y Migraciones en América Latina", *Notas de Población,* N°62 Comisión Económica para América Latina y el Caribe (CEPAL), pp. 211-226.

Lee, E. (1966). "A Theory of Migration", *Demography*, 3(1), pp. 47-57.

Llop, J. et al. (2019). "Las ciudades intermedias: concepto y dimensiones", *Ciudades,* 22, pp. 23-43.

Maccini, S. and Yang, D. (2009). "Under the Weather: Health, Schooling, and Economic Consequences of Early-Life Rainfall", *American Economic Review,* 99(3), pp. 1006-1026.

Marchiori, L., Maystadt, J. F., and Schumacher, I. (2012). "The impact of weather anomalies on migration in sub-Saharan Africa", *Journal of Environmental Economics and Management,* vol. 63, pp. 355-374.

McKinsey Global Institute (2011). "Urban world: Mapping the economic power of cities", McKinsey & Company. March 2011.

Ministerio del Ambiente del Perú (MINAM) (2015). "Mapa de susceptibilidad física del Perú". Documento de trabajo 2015. Lima, MINAM 2015.

Pazos, N. et al. (2023). "Long-Term Effects of Rainfall Shocks on Foundational Cognitive Skills: Evidence from Peru", *Institute of Labor Economics (IZA),* Discussion Paper Series No. 15940, February 2023.

Ponce, C. (2010). "Pobreza y Demografía: una visión de mediano plazo". Informe Final, Consorcio de Investigación Económica y Social (CIES). Grupo de Análisis para el Desarrollo (GRADE). Lima, Septiembre 2010.

Ponce de León, R. G. (2000). "Perú: visión global y de síntesis". Auge Editores SA. Lima, Perú.

Poveda, G. et al. (2020). "High Impact Weather Events in the Andes", *Frontiers in Earth Science,* 8(162), pp. 1-32.

Randell, H. and Gray, C. (2016). "Climate variability and educational attainment: Evidence from rural Ethiopia", *Global Environmental Change,* vol. 41, pp. 111-123.

Ravenstein, E. (1889). "The Laws of Migration", *Journal of the Statistical Society of London,* 48(2), pp. 167-227.

Robalino, J., Jiménez, J., and Chacón, A. (2015). "The Effect of Hydro-Meteorological Emergencies on Internal Migration", *World Development,* vol. 67, pp. 438-448.

Rosales-Rueda, M. (2018). "The Impact of Early Life Shocks on Human Capital Formation: Evidence from El Niño Floods in Ecuador", *Journal of Health Economics,* vol. 62, pp. 13-44.

Sánchez, A. (2015). "Migraciones Internas en el Perú", Organización Internacional para las Migraciones (OIM).

Shah, M. and Steinberg, B. M. (2017). "Drought of opportunities: Contemporaneous and long-term impacts of rainfall shocks on human capital", *Journal of Political Economy,* 125(2), pp. 527-561.

Sun, Q. et al. (2017). "A Review of Global Precipitation Data Sets: Data Sources, Estimation, and Intercomparisons", *Reviews of Geophysics,* 56, pp. 79-107.

Thai, T. and Falaris, E. (2014). "Child Schooling, Child Health, and Rainfall Shocks: Evidence from Rural Vietnam", *The Journal of Development Studies,* 50(7), pp. 1025-1037.

Truth and Reconciliation Commission (CVR) (2003). Final Report. Volume I. Preface. Available at: https://www.cverdad.org.pe/ifinal/pdf/TOMO%20I/PREFACIO.pdf

Vásquez, T. (2019). "Vivir en las ciudades. Análisis de los atributos de migración y no migración en la jerarquía urbana para comprender algunos aspectos del comportamiento social en las ciudades peruanas", *Bulletin de l'Institut Français d'Études Andines,* 48(3), pp. 323-354.

Vega Centeno, P. and Vilela, M. (2019). "El rol de intermediación de las ciudades pequeñas: una lectura de la movilidad cotidiana en Otuzco y Chepén, en la región La Libertad, al norte del Perú", *Investigaciones Geográficas,* 58, pp. 69-88.

Von Hesse, M. (2023). "La Producción agrícola amazónica y su riesgo futuro de ingreso al mercado europeo", en Agraria.pe, Agencia Agraria de Noticias. 24 de Marzo de 2023. https://agraria.pe/noticias/la-produccion-agricola-amazonica-y-su-riesgo-futuro-de-ingre-31264

Waldinger, M. (2015). "The effects of climate change on internal and international migration: implications for developing countries", Centre for Climate Change Economics and Policy Working Paper No. 217. Grantham Research Institute on Climate Change and the Environment Working Paper No. 192. May 2015.

World Bank Group (2022). "Peru. Country Climate and Development Report". November 2022. Available at: https://documents1.worldbank.org/curated/en/099220512062228587/pdf/P1771370b3ea6109108b4403bb881f18f1d.pdf

World Bank Group (2021). Climate Change Knowledge Portal. Available at: https://climateknowledgeportal.worldbank.org/country/peru/climate-data-historical#:~:text=Average%20temperatures%20range%20from%2011,southern%20Andes%20are%20drought%2Dprone.

Appendices:

Appendix 1: Provinces Characteristics – Size and Geographic Region

Province Code	Province	Size (Km2)	Geographic Region
0101	CHACHAPOYAS	3312.37	Highlands
0102	BAGUA	5652.72	Amazon
0103	BONGARA	2869.65	Amazon
0104	CONDORCANQUI	17975.39	Amazon
0105	LUYA	3236.68	Highlands
0106	RODRIGUEZ DE MENDOZA	2359.39	Amazon
0107	UTCUBAMBA	3842.93	Amazon
0201	HUARAZ	2492.91	Highlands
0202	AIJA	696.72	Highlands
0203	ANTONIO RAYMONDI	561.61	Highlands
0204	ASUNCION	528.66	Highlands
0205	BOLOGNESI	3154.8	Highlands
0206	CARHUAZ	803.95	Highlands
0207	CARLOS FERMIN FITZCARRALD	624.25	Highlands
0208	CASMA	2261.03	Coast
0209	CORONGO	988.01	Highlands
0210	HUARI	2771.9	Highlands
0211	HUARMEY	3908.42	Coast
0212	HUAYLAS	2292.78	Highlands
0213	MARISCAL LUZURIAGA	730.58	Highlands
0214	OCROS	1945.07	Highlands
0215	PALLASCA	2101.21	Highlands
0216	POMABAMBA	914.05	Highlands
0217	RECUAY	2304.19	Highlands
0218	SANTA	4008.61	Coast
0219	SIHUAS	1455.97	Highlands
0220	YUNGAY	1361.48	Highlands
0301	ABANCAY	3447.13	Highlands
0302	ANDAHUAYLAS	3987	Highlands
0303	ANTABAMBA	3219.01	Highlands
0304	AYMARAES	4213.07	Highlands
0305	COTABAMBAS	2612.73	Highlands
0306	CHINCHEROS	1242.33	Highlands
0307	GRAU	2174.52	Highlands
0401	AREQUIPA	9682.02	Highlands
0402	CAMANA	3997.73	Coast
0403	CARAVELI	13139.45	Coast
0404	CASTILLA	6914.48	Highlands
0405	CAYLLOMA	14019.46	Coast
0406	CONDESUYOS	6958.4	Highlands
0407	ISLAY	3886.03	Coast
0408	LA UNION	4746.4	Highlands
0501	HUAMANGA	3061.83	Highlands
0502	CANGALLO	1916.17	Highlands
0503	HUANCA SANCOS	2862.33	Highlands
0504	HUANTA	3886.03	Highlands
0505	LA MAR	4304.57	Highlands

0506	LUCANAS	14494.64	Highlands
0507	PARINACOCHAS	5968.32	Highlands
0508	PAUCAR DEL SARA SARA	2096.92	Highlands
0509	SUCRE	1785.64	Highlands
0510	VICTOR FAJARDO	2260.19	Highlands
0511	VILCAS HUAMAN	1178.16	Highlands
0601	CAJAMARCA	2979.78	Highlands
0602	CAJABAMBA	1807.64	Highlands
0603	CELENDIN	2641.59	Highlands
0604	CHOTA	3795.1	Highlands
0605	CONTUMAZA	2070.33	Highlands
0606	CUTERVO	3028.46	Highlands
0607	HUALGAYOC	777.15	Highlands
0608	JAEN	5232.57	Amazon
0609	SAN IGNACIO	4990.3	Amazon
0610	SAN MARCOS	1362.32	Highlands
0611	SAN MIGUEL	2542.08	Highlands
0612	SAN PABLO	672.29	Highlands
0613	SANTA CRUZ	1417.93	Highlands
0701	CALLAO	146.98	Coast
0801	CUSCO	617	Highlands
0802	ACOMAYO	948.22	Highlands
0803	ANTA	1876.12	Highlands
0804	CALCA	4414.49	Highlands
0805	CANAS	2103.76	Highlands
0806	CANCHIS	3999.27	Highlands
0807	CHUMBIVILCAS	5371.08	Highlands
0808	ESPINAR	5311.09	Highlands
0809	LA CONVENCION	30061.82	Amazon
0810	PARURO	1984.42	Highlands
0811	PAUCARTAMBO	6295.01	Highlands
0812	QUISPICANCHI	7564.79	Highlands
0813	URUBAMBA	1439.43	Highlands
0901	HUANCAVELICA	4215.56	Highlands
0902	ACOBAMBA	910.82	Highlands
0903	ANGARAES	1959.03	Highlands
0904	CASTROVIRREYNA	3984.62	Highlands
0905	CHURCAMPA	1218.42	Highlands
0906	HUAYTARA	6458.39	Highlands
0907	TAYACAJA	3384.63	Highlands
1001	HUANUCO	3591.59	Highlands
1002	AMBO	1575.18	Highlands
1003	DOS DE MAYO	1468.07	Highlands
1004	HUACAYBAMBA	1743.7	Highlands
1005	HUAMALIES	3144.5	Highlands
1006	LEONCIO PRADO	4952.99	Amazon
1007	MARAÑON	4801.5	Highlands
1008	PACHITEA	3069.02	Highlands
1009	PUERTO INCA	10086.56	Amazon
1010	LAURICOCHA	1860.89	Highlands
1011	YAROWILCA	727.47	Highlands
1101	ICA	7894.05	Coast
1102	CHINCHA	2987.35	Coast
1103	NAZCA	5234.08	Coast
1104	PALPA	1232.88	Coast
1105	PISCO	3957.15	Coast

1201	HUANCAYO	3558.1	Highlands
1202	CONCEPCION	3067.52	Highlands
1203	CHANCHAMAYO	4725.48	Amazon
1204	JAUJA	3749.1	Highlands
1205	JUNIN	2487.31	Highlands
1206	SATIPO	19219.48	Amazon
1207	TARMA	2749.16	Highlands
1208	YAULI	3617.35	Highlands
1209	CHUPACA	1153.05	Highlands
1301	TRUJILLO	1768.65	Coast
1302	ASCOPE	2655.47	Coast
1303	BOLIVAR	1718.86	Highlands
1304	CHEPEN	1142.43	Coast
1305	JULCAN	1101.39	Highlands
1306	OTUZCO	2110.77	Highlands
1307	PACASMAYO	1126.67	Coast
1308	PATAZ	4226.53	Highlands
1309	SANCHEZ CARRION	2486.38	Highlands
1310	SANTIAGO DE CHUCO	2658.96	Highlands
1311	GRAN CHIMU	1284.77	Coast
1312	VIRU	3214.54	Coast
1401	CHICLAYO	3288.07	Coast
1402	FERREÑAFE	1578.6	Coast
1403	LAMBAYEQUE	9346.63	Coast
1501	LIMA	2670.4	Coast
1502	BARRANCA	1355.87	Coast
1503	CAJATAMBO	1515.21	Highlands
1504	CANTA	1687.29	Highlands
1505	CAÑETE	4574.91	Coast
1506	HUARAL	3655.7	Coast
1507	HUAROCHIRI	5657.93	Highlands
1508	HUAURA	4891.92	Coast
1509	OYON	1886.05	Highlands
1510	YAUYOS	6901.58	Highlands
1601	MAYNAS	73932	Amazon
1602	ALTO AMAZONAS	18764.32	Amazon
1603	LORETO	67434.12	Amazon
1604	MARISCAL RAMON CASTILLA	37412.94	Amazon
1605	REQUENA	49477.8	Amazon
1606	UCAYALI	29293.47	Amazon
1607	DATEM DEL MARAÑON	46609.9	Amazon
1608	PUTUMAYO	45927.89	Amazon
1701	TAMBOPATA	36268.49	Amazon
1702	MANU	27835.17	Amazon
1703	TAHUAMANU	21196.88	Amazon
1801	MARISCAL NIETO	8671.58	Coast
1802	GENERAL SANCHEZ CERRO	5681.71	Highlands
1803	ILO	1380.59	Coast
1901	PASCO	5373.88	Highlands
1902	DANIEL ALCIDES CARRION	1887.23	Highlands
1903	OXAPAMPA	17767.15	Highlands
2001	PIURA	6211.16	Coast
2002	AYABACA	5230.68	Coast
2003	HUANCABAMBA	4254.14	Highlands
2004	MORROPON	3817.92	Coast
2005	PAITA	1784.24	Coast

2006	SULLANA	5423.61	Coast
2007	TALARA	2799.49	Coast
2008	SECHURA	6369.93	Coast
2101	PUNO	6492.6	Highlands
2102	AZANGARO	4970.01	Highlands
2103	CARABAYA	12266.4	Highlands
2104	CHUCUITO	3978.13	Highlands
2105	EL COLLAO	5600.51	Highlands
2106	HUANCANE	2805.85	Highlands
2107	LAMPA	5791.73	Highlands
2108	MELGAR	6446.85	Highlands
2109	MOHO	1003.81	Highlands
2110	SAN ANTONIO DE PUTINA	3207.38	Highlands
2111	SAN ROMAN	2277.63	Highlands
2112	SANDIA	11862.41	Amazon
2113	YUNGUYO	290.21	Highlands
2201	MOYOBAMBA	3772.31	Amazon
2202	BELLAVISTA	8050.9	Amazon
2203	EL DORADO	1298.14	Amazon
2204	HUALLAGA	2380.85	Amazon
2205	LAMAS	5040.67	Amazon
2206	MARISCAL CACERES	14498.73	Amazon
2207	PICOTA	2171.41	Amazon
2208	RIOJA	2535.04	Amazon
2209	SAN MARTIN	5639.82	Amazon
2210	TOCACHE	5865.44	Amazon
2301	TACNA	8066.11	Coast
2302	CANDARAVE	2261.1	Highlands
2303	JORGE BASADRE	2928.56	Coast
2304	TARATA	2819.96	Highlands
2401	TUMBES	1800.15	Coast
2402	CONTRALMIRANTE VILLAR	2123.22	Coast
2403	ZARUMILLA	745.13	Coast
2501	CORONEL PORTILLO	36815.39	Amazon
2502	ATALAYA	38914.29	Amazon
2503	PADRE ABAD	8822.5	Amazon
2504	PURUS	17847.76	Amazon

Annex 2: Provinces and Grids Characteristics – Longitude, Longitude, and Distance (1 Grid Matched)

Province Code	Province	Latitude Capital	Longitude Capital	Latitude Grid	Longitude Grid	Distance Km (Capital to Grid)
0101	CHACHAPOYAS	-6.2294	-77.8728	-6.25	-77.75	13.77
0103	BONGARA	-5.9044	-77.7978	-5.75	-77.75	17.96
0105	LUYA	-6.1392	-77.9522	-6.25	-77.75	25.52
0106	RODRIGUEZ DE MENDOZA	-6.3953	-77.4822	-6.25	-77.25	30.32
0107	UTCUBAMBA	-5.7547	-78.4428	-5.75	-78.25	21.34
0201	HUARAZ	-9.5297	-77.5292	-9.75	-77.75	34.44
0202	AIJA	-9.7803	-77.6106	-9.75	-77.75	15.64
0203	ANTONIO RAYMONDI	-9.1008	-77.0169	-9.25	-77.25	30.5
0204	ASUNCION	-9.1622	-77.3658	-9.25	-77.25	16.03
0205	BOLOGNESI	-10.1519	-77.1564	-10.25	-77.25	14.96
0206	CARHUAZ	-9.2814	-77.6467	-9.25	-77.75	11.86
0207	CARLOS FERMIN FITZCARRALD	-9.0942	-77.3289	-9.25	-77.25	19.37
0208	CASMA	-9.4758	-78.3064	-9.25	-78.25	25.86
0209	CORONGO	-8.5708	-77.8989	-8.75	-77.75	25.79
0210	HUARI	-9.3472	-77.1708	-9.25	-77.25	13.87
0211	HUARMEY	-10.0689	-78.1517	-10.25	-78.25	22.83
0212	HUAYLAS	-9.0486	-77.8047	-9.25	-77.75	23.19
0213	MARISCAL LUZURIAGA	-8.865	-77.3578	-8.75	-77.25	17.43
0214	OCROS	-10.4033	-77.3967	-10.25	-77.25	23.41
0215	PALLASCA	-8.3931	-78.0089	-8.25	-78.25	30.93
0216	POMABAMBA	-8.8211	-77.4603	-8.75	-77.25	24.43
0217	RECUAY	-9.7217	-77.4564	-9.75	-77.25	22.85
0218	SANTA	-9.0417	-78.6078	-9.25	-78.75	27.93
0219	SIHUAS	-8.5544	-77.6308	-8.75	-77.75	25.39
0220	YUNGAY	-9.14	-77.7447	-9.25	-77.25	12.25
0301	ABANCAY	-13.6289	-72.8861	-13.75	-72.75	19.94
0302	ANDAHUAYLAS	-13.6561	-73.3897	-13.75	-73.25	18.35
0303	ANTABAMBA	-14.3653	-72.8772	-14.25	-72.75	18.77
0304	AYMARAES	-14.2944	-73.2447	-14.25	-73.25	4.97
0305	COTABAMBAS	-13.9461	-72.1747	-13.75	-72.25	23.7
0306	CHINCHEROS	-13.5183	-73.7228	-13.75	-73.75	25.93
0307	GRAU	-14.105	-72.7078	-14.25	-72.75	16.75
0402	CAMANA	-16.6247	-72.7114	-16.75	-72.75	15.6
0407	ISLAY	-17.0292	-72.0164	-17.25	-71.75	37.47
0408	LA UNION	-15.2128	-72.8894	-15.25	-72.75	15.52
0501	HUAMANGA	-13.1603	-74.2253	-13.25	-74.25	10.33
0502	CANGALLO	-13.6292	-74.1439	-13.75	-74.25	17.66
0503	HUANCA SANCOS	-13.9197	-74.3342	-13.75	-74.25	20.95
0504	HUANTA	-12.9394	-74.2481	-12.75	-74.25	21.06
0505	LA MAR	-13.0128	-73.9811	-13.25	-73.75	36.6
0508	PAUCAR DEL SARA SARA	-15.2786	-73.3442	-15.25	-73.25	10.59
0509	SUCRE	-14.0117	-73.8386	-14.25	-73.75	28.17
0510	VICTOR FAJARDO	-13.7522	-74.0667	-13.75	-74.25	19.8
0511	VILCAS HUAMAN	-13.6525	-73.9539	-13.75	-73.75	24.55
0601	CAJAMARCA	-7.1547	-78.5108	-7.25	-78.75	28.44
0602	CAJABAMBA	-7.6231	-78.0461	-7.75	-78.25	26.53
0603	CELENDIN	-6.8669	-78.1431	-6.75	-78.25	17.56
0604	CHOTA	-6.5597	-78.6469	-6.75	-78.75	24.03

0605	CONTUMAZA	-7.3667	-78.8053	-7.25	-78.75	14.34
0606	CUTERVO	-6.3772	-78.8181	-6.25	-78.75	16.02
0607	HUALGAYOC	-6.6797	-78.5189	-6.75	-78.75	26.69
0609	SAN IGNACIO	-5.1461	-79.0047	-5.25	-79.25	29.52
0610	SAN MARCOS	-7.3358	-78.17	-7.25	-78.25	13
0611	SAN MIGUEL	-7	-78.85	-7.25	-78.75	29.91
0612	SAN PABLO	-7.1186	-78.8233	-7.25	-78.75	16.7
0613	SANTA CRUZ	-6.6258	-78.9442	-6.75	-78.75	25.51
0701	CALLAO	-12.0631	-77.1469	-12.25	-77.25	23.61
0801	CUSCO	-13.5192	-71.9767	-13.75	-71.75	35.48
0802	ACOMAYO	-13.9194	-71.6836	-13.75	-71.75	20.15
0803	ANTA	-13.4578	-72.1475	-13.25	-72.25	25.63
0804	CALCA	-13.3211	-71.9556	-13.25	-71.75	23.61
0805	CANAS	-14.2167	-71.4322	-14.25	-71.25	19.98
0806	CANCHIS	-14.2381	-71.2308	-14.25	-71.25	2.46
0810	PARURO	-13.7617	-71.8478	-13.75	-71.75	10.64
0813	URUBAMBA	-13.3056	-72.1161	-13.25	-72.25	15.75
0901	HUANCAVELICA	-12.7869	-74.9714	-12.75	-74.75	24.36
0902	ACOBAMBA	-12.8431	-74.5692	-12.75	-74.75	22.17
0903	ANGARAES	-12.9828	-74.7183	-12.75	-74.75	26.11
0904	CASTROVIRREYNA	-13.2833	-75.3183	-13.25	-75.25	8.26
0905	CHURCAMPA	-12.7392	-74.3872	-12.75	-74.25	14.94
0907	TAYACAJA	-12.3992	-74.8683	-12.25	-74.75	20.99
1001	HUANUCO	-9.93	-76.2397	-9.75	-76.25	20.05
1002	AMBO	-10.1292	-76.2044	-10.25	-76.25	14.33
1003	DOS DE MAYO	-9.8378	-76.8036	-9.75	-76.75	11.39
1004	HUACAYBAMBA	-9.0381	-76.9525	-9.25	-76.75	32.39
1005	HUAMALIES	-9.5497	-76.8186	-9.75	-76.75	23.51
1006	LEONCIO PRADO	-9.2981	-76.0006	-9.25	-76.25	28.89
1007	MARAÑON	-8.6047	-77.1492	-8.75	-77.25	19.59
1008	PACHITEA	-9.8975	-75.9942	-9.75	-75.75	31.38
1010	LAURICOCHA	-10.0783	-76.6314	-10.25	-76.75	23.09
1011	YAROWILCA	-9.8589	-76.6089	-9.75	-76.75	19.64
1102	CHINCHA	-13.4183	-76.1325	-13.25	-76.25	22.62
1104	PALPA	-14.5339	-75.185	-14.75	-75.25	25.03
1105	PISCO	-13.71	-76.2017	-13.75	-76.25	6.86
1201	HUANCAYO	-12.0708	-75.2089	-12.25	-75.25	20.42
1202	CONCEPCION	-11.9189	-75.3125	-11.75	-75.25	19.96
1203	CHANCHAMAYO	-11.0567	-75.3275	-11.25	-75.25	23.1
1204	JAUJA	-11.7756	-75.5006	-11.75	-75.75	27.3
1205	JUNIN	-11.1614	-75.9983	-11.25	-75.75	17.91
1207	TARMA	-11.42	-75.6881	-11.25	-75.75	20.07
1208	YAULI	-11.5219	-75.9078	-11.75	-75.75	30.64
1209	CHUPACA	-12.0578	-75.2894	-12.25	-75.25	21.8
1301	TRUJILLO	-8.1	-79.0306	-8.25	-79.25	29.35
1302	ASCOPE	-7.7136	-79.1072	-7.75	-79.25	16.25
1303	BOLIVAR	-7.1539	-77.7022	-7.25	-77.75	11.92
1304	CHEPEN	-7.2275	-79.4294	-7.25	-79.25	19.95
1305	JULCAN	-8.0428	-78.4864	-8.25	-78.25	34.77
1306	OTUZCO	-7.9022	-78.5656	-7.75	-78.75	26.44
1307	PACASMAYO	-7.4183	-79.5147	-7.25	-79.75	31.99
1308	PATAZ	-8.275	-77.2961	-8.25	-77.25	5.78
1309	SANCHEZ CARRION	-7.8111	-78.0467	-7.75	-78.25	23.41
1310	SANTIAGO DE CHUCO	-8.1453	-78.1736	-8.25	-78.25	14.36
1311	GRAN CHIMU	-7.4794	-78.8197	-7.25	-78.75	26.64
1312	VIRU	-8.4144	-78.7528	-8.25	-78.75	18.28
1401	CHICLAYO	-6.7669	-79.8506	-6.75	-79.75	11.27

1402	FERREÑAFE	-6.6389	-79.7883	-6.75	-79.75	13.06
1501	LIMA	-12.0453	-77.0308	-12.25	-77.25	32.95
1502	BARRANCA	-10.7533	-77.765	-10.75	-77.75	1.68
1503	CAJATAMBO	-10.4731	-76.9931	-10.25	-76.75	36.37
1504	CANTA	-11.4672	-76.6244	-11.25	-76.75	27.76
1505	CAÑETE	-13.0778	-76.3878	-13.25	-76.25	24.27
1506	HUARAL	-11.4953	-77.2069	-11.25	-77.25	27.68
1508	HUAURA	-11.1081	-77.6103	-11.25	-77.75	21.94
1509	OYON	-10.6681	-76.7733	-10.75	-76.75	9.46
1803	ILO	-17.625	-71.3433	-17.75	-71.25	17.06
1902	DANIEL ALCIDES CARRION	-10.4914	-76.5164	-10.25	-76.75	37.06
2003	HUANCABAMBA	-5.2386	-79.4503	-5.25	-79.25	22.22
2004	MORROPON	-5.0972	-80.1603	-5.25	-80.25	19.68
2005	PAITA	-5.0931	-81.0994	-5.25	-81.25	24.14
2007	TALARA	-4.5794	-81.2694	-4.75	-81.25	19.09
2102	AZANGARO	-14.9081	-70.1956	-14.75	-70.25	18.53
2104	CHUCUITO	-16.2128	-69.4594	-16.25	-69.25	22.74
2106	HUANCANE	-15.2008	-69.7678	-15.25	-69.75	5.79
2109	MOHO	-15.3603	-69.4997	-15.25	-69.25	29.46
2110	SAN ANTONIO DE PUTINA	-14.9142	-69.8689	-14.75	-69.75	22.29
2111	SAN ROMAN	-15.4839	-70.1333	-15.25	-70.25	28.86
2113	YUNGUYO	-16.2267	-69.0956	-16.25	-69.25	16.68
2201	MOYOBAMBA	-6.0347	-76.9742	-6.25	-76.75	34.46
2203	EL DORADO	-6.6139	-76.6953	-6.75	-76.75	16.29
2204	HUALLAGA	-6.9367	-76.7722	-6.75	-76.75	20.9
2207	PICOTA	-6.92	-76.3303	-6.75	-76.25	20.88
2208	RIOJA	-6.0625	-77.1683	-6.25	-77.25	22.72
2302	CANDARAVE	-17.2681	-70.2503	-17.25	-70.25	2.01
2303	JORGE BASADRE	-17.6139	-70.7628	-17.75	-70.75	15.19
2304	TARATA	-17.475	-70.0319	-17.25	-70.25	34.08
2401	TUMBES	-3.5711	-80.4592	-3.75	-80.25	30.57
2402	CONTRALMIRANTE VILLAR	-3.6775	-80.6681	-3.75	-80.75	12.15
2403	ZARUMILLA	-3.5011	-80.2756	-3.75	-80.25	27.82

Annex 3: Provinces and Grids Characteristics – Longitude, Longitude, and Distance (2 Grids Matched)

Province Code	Province	Latitude Capital	Longitude Capital	Latitude Grid 1	Longitude Grid 1	Latitude Grid 2	Longitude Grid 2	Distance Km (Capital to Grid 1)	Distance Km (Capital to Grid 2)
0102	BAGUA	-5.6389	-78.5311	-5.75	-78.75	-5.75	-78.25	27.18	33.49
0401	AREQUIPA	-16.3933	-71.5289	-16.25	-71.75	-16.25	-71.25	28.47	33.76
0404	CASTILLA	-16.0761	-72.4922	-16.25	-72.25	-16.25	-72.75	32.3	33.64
0406	CONDESUYOS	-15.8394	-72.6517	-15.75	-72.75	-15.75	-72.25	14.47	44.12
0507	PARINACOCHAS	-15.0169	-73.7814	-15.25	-73.75	-14.75	-73.75	26.14	29.87
0608	JAEN	-5.7089	-78.8092	-5.75	-78.75	-5.75	-79.25	7.99	48.98
0807	CHUMBIVILCAS	-14.4533	-72.0822	-14.25	-72.25	-14.75	-72.25	28.94	37.61
0808	ESPINAR	-14.7931	-71.4133	-14.75	-71.25	-14.75	-71.75	18.19	36.52
0811	PAUCARTAMBO	-13.3178	-71.5967	-13.25	-71.75	-13.25	-71.25	18.22	38.27
0812	QUISPICANCHI	-13.6878	-71.6253	-13.75	-71.75	-13.75	-71.25	15.14	41.13
0906	HUAYTARA	-13.6047	-75.3531	-13.75	-75.25	-13.25	-75.25	19.62	40.99
1101	ICA	-14.0636	-75.7292	-14.25	-75.75	-13.75	-75.75	20.85	34.94
1103	NAZCA	-14.8269	-74.9372	-14.75	-74.75	-14.75	-75.25	21.87	34.7
1403	LAMBAYEQUE	-6.7069	-79.8953	-6.75	-79.75	-6.75	-80.25	16.75	39.46
1507	HUAROCHIRI	-11.845	-76.3861	-11.75	-76.25	-11.75	-76.75	18.19	40.99
1510	YAUYOS	-12.4597	-75.9183	-12.25	-75.75	-12.75	-75.75	29.63	37.09
1801	MARISCAL NIETO GENERAL	-17.1942	-70.9333	-17.25	-70.75	-17.25	-71.25	20.43	34.2
1802	SANCHEZ CERRO	-16.6736	-70.9706	-16.75	-70.75	-16.75	-71.25	24.98	30.94
1901	PASCO	-10.6825	-76.2569	-10.75	-76.25	-10.25	-76.25	7.54	48.1
2001	PIURA	-5.1525	-80.6578	-5.25	-80.75	-5.25	-80.25	14.89	46.44
2002	AYABACA	-4.6406	-79.7153	-4.75	-79.75	-4.25	-79.75	12.76	43.6
2006	SULLANA	-4.8906	-80.6878	-4.75	-80.75	-5.25	-80.75	17.09	40.55
2008	SECHURA	-5.5572	-80.8222	-5.75	-80.75	-5.25	-80.75	22.88	35.08
2101	PUNO	-15.8403	-70.0281	-15.75	-70.25	-15.75	-69.75	25.78	31.4
2105	EL COLLAO	-16.0869	-69.6381	-16.25	-69.75	-15.75	-69.75	21.72	39.33
2107	LAMPA	-15.3647	-70.3678	-15.25	-70.25	-15.25	-70.75	17.95	42.93
2108	MELGAR	-14.8817	-70.5894	-14.75	-70.75	-14.75	-70.25	22.64	39.31
2202	BELLAVISTA	-7.0522	-76.5897	-7.25	-76.75	-6.75	-76.75	28.22	37.98
2205	LAMAS	-6.4239	-76.5233	-6.25	-76.75	-6.25	-76.25	31.64	35.87
2209	SAN MARTIN	-6.4894	-76.3603	-6.25	-76.25	-6.75	-76.25	29.28	31.43
2210	TOCACHE	-8.1883	-76.5094	-8.25	-76.75	-8.25	-76.25	27.35	29.36
2301	TACNA	-18.0019	-70.2519	-18.25	-70.25	-17.75	-70.25	27.59	28.01
2503	PADRE ABAD	-9.0336	-75.5075	-9.25	-75.75	-9.25	-75.25	35.89	37.12
0104	CONDORCANQUI	-4.5922	-77.8644	-4.75	-77.75	-4.25	-77.75	21.65	40.11
0403	CARAVELI	-15.7725	-73.3658	-15.75	-73.25	-15.75	-73.75	12.64	41.19
0405	CAYLLOMA	-15.6403	-71.6036	-15.75	-71.75	-15.75	-71.25	19.86	39.77
0506	LUCANAS	-14.6942	-74.1244	-14.75	-74.25	-14.75	-73.75	14.86	40.74
0809	LA CONVENCION	-12.8628	-72.6933	-12.75	-72.75	-13.25	-72.75	13.97	43.49
1009	PUERTO INCA	-9.3789	-74.9658	-9.25	-74.75	-9.25	-75.25	27.68	34.32
1206	SATIPO	-11.2539	-74.6361	-11.25	-74.75	-11.25	-74.25	12.43	42.11
1601	MAYNAS	-3.7481	-73.2442	-3.75	-73.25	-3.75	-72.75	0.678	54.84
1602	ALTO AMAZONAS	-5.8842	-76.1281	-5.75	-76.25	-6.25	-76.25	20.11	42.85
1603	LORETO	-4.5014	-73.5694	-4.75	-73.75	-4.25	-73.75	34.11	34.39
1604	MARISCAL RAMON CASTILLA	-3.9061	-70.5169	-3.75	-70.75	-3.75	-70.25	31.15	34.32
1605	REQUENA	-5.0639	-73.8567	-5.25	-73.75	-4.75	-73.75	23.83	36.85

1506	UCAYALI	-7.3506	-75.0097	-7.25	-75.25	-7.25	-74.75	28.77	30.75
1607	DATEM DEL MARAÑON	-4.8311	-76.555	-4.75	-76.75	-4.75	-76.25	23.41	34.98
1608	PUTUMAYO	-2.4469	-72.6681	-2.25	-72.75	-2.75	-72.75	23.71	34.91
1701	TAMBOPATA	-12.5936	-69.1767	-12.75	-69.25	-12.25	-69.25	19.12	39.03
1702	MANU	-12.8372	-71.3653	-12.75	-71.25	-12.75	-71.75	15.82	42.83
1703	TAHUAMANU	-10.945	-69.5767	-10.75	-69.75	-11.25	-69.75	28.78	38.83
1903	OXAPAMPA	-10.575	-75.4047	-10.75	-75.25	-10.25	-75.25	24.57	39.89
2103	CARABAYA	-14.0686	-70.4311	-14.25	-70.25	-13.75	-70.25	28.07	40.48
2112	SANDIA	-14.3222	-69.4664	-14.25	-69.25	-14.25	-69.75	24.66	31.6
2206	MARISCAL CACERES	-7.1767	-76.7239	-7.25	-76.75	-6.75	-76.75	8.65	47.52
2501	CORONEL PORTILLO	-8.3681	-74.5433	-8.25	-74.75	-8.25	-74.25	26.26	34.84
2502	ATALAYA	-10.7297	-73.7553	-10.75	-73.75	-10.25	-73.75	2.33	53.34
2504	PURUS	-9.7722	-70.7097	-9.75	-70.75	-9.75	-70.25	5.06	50.44

Annex 4: Provinces Characteristics – Sum of Monthly Precipitation and Mean of Excess Rainfall (2007-2010)

Province Code	Province	Sum of Monthly Precipitation (Dec-Mar 2007)	Sum of Monthly Precipitation (Dec-Mar 2008)	Sum of Monthly Precipitation (Dec-Mar 2009)	Sum of Monthly Precipitation (Dec-Mar 2010)	Mean Excess Rainfall (S.D) (2007)	Mean Excess Rainfall (S.D) (2008)	Mean Excess Rainfall (S.D) (2009)	Mean Excess Rainfall (S.D) (2010)
0101	CHACHAPOYAS	518.50	555.30	563.70	448.20	0.443	0.777	1.019	0.095
0102	BAGUA	426.22	572.45	521.79	443.11	0.192	0.948	0.919	0.271
0103	BONGARA	563.60	632.00	619.90	537.40	0.267	0.885	0.912	0.169
0104	CONDORCANQUI	742.82	969.74	876.68	853.76	-0.237	1.126	0.469	0.207
0105	LUYA	518.50	555.30	563.70	448.20	0.443	0.777	1.019	0.095
0106	RODRIGUEZ DE MENDOZA	631.80	615.50	658.40	501.40	0.556	0.700	0.913	-0.036
0107	UTCUBAMBA	461.60	560.80	533.60	464.80	0.176	0.886	0.875	0.226
0201	HUARAZ	208.30	201.70	512.20	249.00	-0.282	-0.424	0.892	0.337
0202	AIJA	208.30	201.70	512.20	249.00	-0.282	-0.424	0.892	0.337
0203	ANTONIO RAYMONDI	406.00	404.30	645.70	480.10	-0.160	-0.192	0.912	0.213
0204	ASUNCION	406.00	404.30	645.70	480.10	-0.160	-0.192	0.912	0.213
0205	BOLOGNESI	225.90	205.80	742.30	448.20	-0.521	-0.551	0.489	0.598
0206	CARHUAZ	403.20	403.30	757.70	441.30	-0.051	-0.210	1.111	0.256
0207	CARLOS FERMIN FITZCARRALD	406.00	404.30	645.70	480.10	-0.160	-0.192	0.912	0.213
0208	CASMA	96.00	103.20	200.80	97.60	0.080	-0.109	1.267	0.245
0209	CORONGO	496.80	511.50	817.40	422.30	0.226	0.122	1.263	-0.062
0210	HUARI	406.00	404.30	645.70	480.10	-0.160	-0.192	0.912	0.213
0211	HUARMEY	24.10	21.50	79.10	34.00	-0.394	-0.495	0.785	0.374
0212	HUAYLAS	403.20	403.30	757.70	441.30	-0.051	-0.210	1.111	0.256
0213	MARISCAL LUZURIAGA	413.40	407.20	587.40	372.60	0.104	0.039	1.080	-0.123
0214	OCROS	225.90	205.80	742.30	448.20	-0.521	-0.551	0.489	0.598
0215	PALLASCA	523.60	549.30	718.00	356.90	0.589	0.436	1.327	-0.136
0216	POMABAMBA	413.40	407.20	587.40	372.60	0.104	0.039	1.080	-0.123
0217	RECUAY	303.80	304.20	631.10	453.20	-0.380	-0.378	0.691	0.346
0218	SANTA	9.00	12.80	20.30	8.30	0.318	0.100	1.341	0.150
0219	SIHUAS	496.80	511.50	817.40	422.30	0.226	0.122	1.263	-0.062
0220	YUNGAY	406.00	404.30	645.70	480.10	-0.160	-0.192	0.912	0.213
0301	ABANCAY	471.30	522.00	419.90	468.60	-0.113	-0.077	-0.431	-0.265
0302	ANDAHUAYLAS	485.10	497.20	428.00	504.10	0.019	-0.204	-0.337	-0.073
0303	ANTABAMBA	491.60	614.10	453.60	465.50	-0.175	0.055	-0.384	-0.402
0304	AYMARAES	491.60	564.60	456.40	484.90	-0.098	-0.076	-0.318	-0.288
0305	COTABAMBAS	477.40	570.20	423.10	459.60	-0.178	0.025	-0.486	-0.402
0306	CHINCHEROS	508.10	495.70	455.90	576.70	0.136	-0.280	-0.156	0.413
0307	GRAU	491.60	614.10	453.60	465.50	-0.175	0.055	-0.384	-0.402
0401	AREQUIPA	132.55	180.70	116.81	71.10	-0.455	-0.051	-0.647	-0.939
0402	CAMANA	0.40	0.50	0.40	0.20	-0.552	0.069	-0.615	-0.822
0403	CARAVELI	75.28	109.27	82.50	65.09	-0.229	0.134	-0.258	-0.453
0404	CASTILLA	7.47	11.00	6.80	4.73	-0.398	0.239	-0.445	-0.679
0405	CAYLLOMA	288.36	389.19	263.36	209.19	-0.467	0.041	-0.618	-0.868
0406	CONDESUYOS	182.29	281.77	177.85	144.79	-0.306	0.175	-0.421	-0.612
0407	ISLAY	7.40	15.60	5.80	3.70	-0.422	0.044	-0.604	-0.922
0408	LA UNION	385.10	543.00	376.10	338.40	-0.232	0.156	-0.342	-0.498
0501	HUAMANGA	473.20	417.20	482.20	660.10	-0.081	-0.383	-0.053	1.087
0502	CANGALLO	511.10	470.50	504.10	650.80	0.014	-0.309	-0.040	0.953
0503	HUANCA SANCOS	511.10	470.50	504.10	650.80	0.014	-0.309	-0.040	0.953

0504	HUANTA	416.50	363.40	445.80	623.70	-0.236	-0.497	-0.122	1.067
0505	LA MAR	493.50	443.70	440.30	606.20	0.130	-0.414	-0.184	0.835
0506	LUCANAS	437.17	484.33	429.00	440.92	0.039	0.011	-0.052	-0.047
0507	PARINACOCHAS	409.21	482.06	409.20	396.12	-0.054	0.025	-0.127	-0.216
0508	PAUCAR DEL SARA SARA	338.60	457.50	341.00	309.90	-0.198	0.100	-0.278	-0.430
0509	SUCRE	515.30	545.30	476.40	528.80	0.053	-0.136	-0.165	-0.084
0510	VICTOR FAJARDO	511.10	470.50	504.10	650.80	0.014	-0.309	-0.040	0.953
0511	VILCAS HUAMAN	508.10	495.70	455.90	576.70	0.136	-0.280	-0.156	0.413
0601	CAJAMARCA	526.70	664.70	717.40	421.90	0.489	0.695	1.255	0.046
0602	CAJABAMBA	653.20	642.50	794.90	448.60	0.612	0.517	1.303	-0.051
0603	CELENDIN	601.20	632.70	667.40	498.20	0.492	0.683	1.143	0.122
0604	CHOTA	628.20	752.20	782.10	536.40	0.385	0.793	1.164	0.124
0605	CONTUMAZA	526.70	664.70	717.40	421.90	0.489	0.695	1.255	0.046
0606	CUTERVO	430.20	591.90	542.80	419.40	0.307	0.914	1.048	0.227
0607	HUALGAYOC	628.20	752.20	782.10	536.40	0.385	0.793	1.164	0.124
0608	JAEN	395.10	599.42	518.19	429.38	0.207	1.005	0.951	0.316
0609	SAN IGNACIO	403.70	716.90	571.70	494.00	0.125	1.151	0.897	0.406
0610	SAN MARCOS	661.40	640.90	749.90	488.10	0.560	0.612	1.253	0.037
0611	SAN MIGUEL	526.70	664.70	717.40	421.90	0.489	0.695	1.255	0.046
0612	SAN PABLO	526.70	664.70	717.40	421.90	0.489	0.695	1.255	0.046
0613	SANTA CRUZ	628.20	752.20	782.10	536.40	0.385	0.793	1.164	0.124
0701	CALLAO	0.50	0.00	1.70	21.80	-0.504	-0.632	-0.136	1.045
0801	CUSCO	479.80	569.20	417.50	452.00	-0.181	0.048	-0.528	-0.445
0802	ACOMAYO	479.80	569.20	417.50	452.00	-0.181	0.048	-0.528	-0.445
0803	ANTA	501.10	519.20	430.80	508.00	-0.049	-0.153	-0.535	-0.150
0804	CALCA	512.30	523.20	440.90	523.80	-0.045	-0.198	-0.556	-0.125
0805	CANAS	512.80	633.30	461.30	457.50	-0.296	0.116	-0.544	-0.613
0806	CANCHIS	512.80	633.30	461.30	457.50	-0.296	0.116	-0.544	-0.613
0807	CHUMBIVILCAS	500.21	659.83	461.54	452.57	-0.242	0.144	-0.427	-0.516
0808	ESPINAR	508.13	658.18	465.97	442.34	-0.345	0.151	-0.536	-0.661
0809	LA CONVENCION	649.52	574.92	533.51	707.47	0.223	-0.275	-0.453	0.463
0810	PARURO	479.80	569.20	417.50	452.00	-0.181	0.048	-0.528	-0.445
0811	PAUCARTAMBO	607.35	614.15	526.24	631.30	-0.048	-0.214	-0.543	-0.082
0812	QUISPICANCHI	487.17	571.86	425.49	458.62	-0.189	0.034	-0.536	-0.451
0813	URUBAMBA	501.10	519.20	430.80	508.00	-0.049	-0.153	-0.535	-0.150
0901	HUANCAVELICA	353.90	291.40	444.80	688.50	-0.383	-0.550	-0.130	1.038
0902	ACOBAMBA	353.90	291.40	444.80	688.50	-0.383	-0.550	-0.130	1.038
0903	ANGARAES	353.90	291.40	444.80	688.50	-0.383	-0.550	-0.130	1.038
0904	CASTROVIRREYNA	281.90	197.90	448.20	726.70	-0.428	-0.569	-0.120	1.055
0905	CHURCAMPA	416.50	363.40	445.80	623.70	-0.236	-0.497	-0.122	1.067
0906	HUAYTARA	263.64	201.62	398.36	516.85	-0.374	-0.508	-0.093	1.058
0907	TAYACAJA	303.90	242.00	411.50	682.20	-0.448	-0.605	-0.146	1.066
1001	HUANUCO	276.40	317.50	411.30	468.70	-0.485	-0.194	0.201	0.462
1002	AMBO	287.60	325.80	478.50	669.00	-0.512	-0.296	0.031	0.722
1003	DOS DE MAYO	346.80	368.70	585.30	558.70	-0.383	-0.263	0.449	0.388
1004	HUACAYBAMBA	352.30	373.30	530.40	442.80	-0.294	-0.154	0.677	0.145
1005	HUAMALIES	346.80	368.70	585.30	558.70	-0.383	-0.263	0.449	0.388
1006	LEONCIO PRADO	609.30	719.70	898.10	843.00	-0.431	-0.096	0.412	0.204
1007	MARAÑON	413.40	407.20	587.40	372.60	0.104	0.039	1.080	-0.123
1008	PACHITEA	566.00	744.80	790.10	1033.30	-0.585	-0.065	-0.020	0.606
1009	PUERTO INCA	1308.38	1950.80	1552.41	1546.58	-0.482	0.585	-0.249	0.077
1010	LAURICOCHA	267.30	273.80	613.00	671.00	-0.514	-0.423	0.231	0.665
1011	YAROWILCA	346.80	368.70	585.30	558.70	-0.383	-0.263	0.449	0.388
1101	ICA	8.99	5.65	26.48	9.44	-0.368	-0.467	-0.046	1.057
1102	CHINCHA	5.80	1.30	30.00	8.80	-0.475	-0.603	-0.110	1.048
1103	NAZCA	94.74	99.20	98.93	101.03	0.026	-0.056	0.056	0.493
1104	PALPA	2.30	2.10	2.50	2.70	0.013	-0.166	0.090	0.633

1105	PISCO	0.90	0.30	2.00	4.40	-0.467	-0.604	-0.095	1.055
1201	HUANCAYO	242.30	132.70	454.40	981.70	-0.526	-0.661	-0.163	1.079
1202	CONCEPCION	259.60	185.30	490.20	992.00	-0.572	-0.617	-0.164	0.993
1203	CHANCHAMAYO	416.80	427.80	710.20	1249.70	-0.595	-0.455	-0.121	0.909
1204	JAUJA	156.60	68.90	429.00	886.20	-0.571	-0.649	-0.171	0.986
1205	JUNIN	212.30	186.20	442.40	900.60	-0.601	-0.527	-0.140	0.932
1206	SATIPO	655.22	693.51	812.55	1151.46	-0.486	-0.314	-0.094	0.827
1207	TARMA	212.30	186.20	442.40	900.60	-0.601	-0.527	-0.140	0.932
1208	YAULI	156.60	68.90	429.00	886.20	-0.571	-0.649	-0.171	0.986
1209	CHUPACA	242.30	132.70	454.40	981.70	-0.526	-0.661	-0.163	1.079
1301	TRUJILLO	10.80	20.80	16.80	10.40	0.574	0.755	1.403	-0.107
1302	ASCOPE	29.80	69.20	63.20	32.30	0.508	0.736	1.318	-0.034
1303	BOLIVAR	687.80	609.60	697.80	473.50	0.634	0.546	1.151	-0.055
1304	CHEPEN	137.60	300.30	267.80	148.50	0.408	0.754	1.234	0.071
1305	JULCAN	523.60	549.30	718.00	356.90	0.589	0.436	1.327	-0.136
1306	OTUZCO	307.40	439.50	484.30	247.10	0.587	0.629	1.336	-0.035
1307	PACASMAYO	9.50	14.40	12.40	9.40	0.321	0.767	1.181	0.112
1308	PATAZ	548.30	508.80	647.30	393.70	0.455	0.310	0.989	-0.249
1309	SANCHEZ CARRION	653.20	642.50	794.90	448.60	0.612	0.517	1.303	-0.051
1310	SANTIAGO DE CHUCO	523.60	549.30	718.00	356.90	0.589	0.436	1.327	-0.136
1311	GRAN CHIMU	526.70	664.70	717.40	421.90	0.489	0.695	1.255	0.046
1312	VIRU	138.80	197.80	227.30	108.00	0.635	0.584	1.360	-0.105
1401	CHICLAYO	30.30	99.10	57.00	45.70	0.338	0.919	1.081	0.291
1402	FERREÑAFE	30.30	99.10	57.00	45.70	0.338	0.919	1.081	0.291
1403	LAMBAYEQUE	24.94	84.86	44.66	38.97	0.331	0.925	1.044	0.329
1501	LIMA	13.70	0.00	81.60	27.00	-0.500	-0.628	-0.132	1.003
1502	BARRANCA	13.70	7.60	63.10	23.80	-0.529	-0.656	0.419	0.710
1503	CAJATAMBO	267.30	273.80	613.00	671.00	-0.514	-0.423	0.231	0.665
1504	CANTA	134.60	44.30	451.30	667.40	-0.559	-0.627	-0.145	0.965
1505	CAÑETE	5.80	1.30	30.00	8.80	-0.475	-0.603	-0.110	1.048
1506	HUARAL	22.00	3.00	111.50	24.40	-0.536	-0.667	-0.022	0.925
1507	HUAROCHIRI	120.64	15.95	418.34	712.58	-0.552	-0.668	-0.171	0.997
1508	HUAURA	0.30	0.00	0.80	0.90	-0.341	-0.667	-0.096	0.778
1509	OYON	191.40	150.50	547.00	682.10	-0.560	-0.534	0.024	0.851
1510	YAUYOS	167.80	39.06	484.38	897.37	-0.518	-0.648	-0.149	1.020
1601	MAYNAS	1842.33	2036.23	1267.49	1108.04	1.220	1.754	0.144	-0.109
1602	ALTO AMAZONAS	923.21	875.09	840.94	840.24	0.394	0.238	0.016	-0.042
1603	LORETO	1562.22	1691.45	1039.13	970.04	1.284	1.760	-0.022	-0.100
1604	MARISCAL RAMON CASTILLA	1684.34	1706.41	1769.99	1392.26	0.965	1.043	1.134	0.277
1605	REQUENA	1417.70	1532.50	1014.16	938.73	1.250	1.705	-0.039	-0.130
1606	UCAYALI	720.00	829.44	682.48	667.86	0.023	0.435	-0.285	-0.120
1607	DATEM DEL MARAÑON	883.64	889.84	831.90	911.18	0.200	0.356	-0.025	0.053
1608	PUTUMAYO	1744.66	1888.76	1211.38	1055.16	1.188	1.711	0.127	-0.109
1701	TAMBOPATA	1136.18	1195.78	1273.55	1609.83	-0.378	-0.377	0.069	1.038
1702	MANU	1424.33	1304.08	1243.13	1721.43	0.187	-0.340	-0.380	0.732
1703	TAHUAMANU	985.90	1004.83	1090.91	1673.90	-0.150	-0.151	0.141	1.890
1801	MARISCAL NIETO	25.47	39.16	21.27	11.87	-0.389	-0.010	-0.421	-0.807
1802	GENERAL SANCHEZ CERRO	111.88	164.68	103.02	53.58	-0.524	-0.046	-0.571	-0.971
1803	ILO	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000
1901	PASCO	269.01	273.07	533.05	927.22	-0.566	-0.417	-0.071	0.855
1902	DANIEL ALCIDES CARRION	267.30	273.80	613.00	671.00	-0.514	-0.423	0.231	0.665
1903	OXAPAMPA	703.63	875.36	984.14	1421.57	-0.596	-0.180	-0.084	0.771

2001	PIURA	31.75	129.66	62.66	55.58	0.293	1.083	0.822	0.531
2002	AYABACA	361.12	1047.53	633.68	587.53	-0.068	1.131	0.638	0.510
2003	HUANCABAMBA	403.70	716.90	571.70	494.00	0.125	1.151	0.897	0.406
2004	MORROPON	71.50	299.50	145.20	123.50	0.154	1.117	0.772	0.541
2005	PAITA	8.10	30.10	12.40	14.90	0.301	1.002	0.707	0.648
2006	SULLANA	34.76	149.28	63.36	61.66	0.112	1.012	0.652	0.566
2007	TALARA	15.70	66.50	28.60	30.60	0.124	0.881	0.442	0.695
2008	SECHURA	17.12	69.51	30.09	30.29	0.323	1.051	0.852	0.547
2101	PUNO	418.83	539.48	427.21	332.12	-0.565	-0.145	-0.480	-0.842
2102	AZANGARO	424.60	494.90	421.30	407.40	-0.488	-0.207	-0.479	-0.602
2103	CARABAYA	626.29	693.88	622.64	653.63	-0.397	-0.197	-0.422	-0.343
2104	CHUCUITO	487.20	483.50	411.90	335.20	-0.190	-0.267	-0.521	-0.882
2105	EL COLLAO	437.40	526.22	420.97	340.26	-0.510	-0.214	-0.543	-0.853
2106	HUANCANE	404.30	494.00	424.00	389.50	-0.582	-0.250	-0.398	-0.601
2107	LAMPA	419.26	529.99	416.34	384.53	-0.522	-0.102	-0.505	-0.667
2108	MELGAR	453.79	536.97	432.72	417.74	-0.435	-0.102	-0.522	-0.635
2109	MOHO	408.20	478.20	425.80	373.30	-0.542	-0.265	-0.357	-0.645
2110	SAN ANTONIO DE PUTINA	407.30	472.50	431.50	409.00	-0.562	-0.310	-0.374	-0.542
2111	SAN ROMAN	398.00	499.00	399.80	375.80	-0.523	-0.121	-0.475	-0.622
2112	SANDIA	547.06	611.61	593.75	595.42	-0.522	-0.300	-0.269	-0.270
2113	YUNGUYO	487.20	483.50	411.90	335.20	-0.190	-0.267	-0.521	-0.882
2201	MOYOBAMBA	702.90	656.90	726.90	544.50	0.608	0.516	0.711	-0.141
2202	BELLAVISTA	643.08	600.27	692.85	477.70	0.566	0.381	0.721	-0.268
2203	EL DORADO	582.50	540.60	620.50	430.60	0.641	0.437	0.720	-0.208
2204	HUALLAGA	582.50	540.60	620.50	430.60	0.641	0.437	0.720	-0.208
2205	LAMAS	766.92	744.96	775.69	627.31	0.471	0.421	0.439	-0.155
2206	MARISCAL CACERES	671.84	628.58	727.18	500.06	0.531	0.355	0.721	-0.296
2207	PICOTA	474.30	482.90	496.50	407.20	0.186	0.179	0.144	-0.203
2208	RIOJA	631.80	615.50	658.40	501.40	0.556	0.700	0.913	-0.036
2209	SAN MARTIN	663.37	670.26	669.67	569.76	0.252	0.249	0.137	-0.186
2210	TOCACHE	949.28	1011.31	1187.02	807.34	0.045	0.185	0.609	-0.374
2301	TACNA	9.84	13.22	6.91	4.72	-0.184	-0.279	-0.551	-0.816
2302	CANDARAVE	160.10	191.80	111.90	74.90	-0.340	-0.290	-0.567	-0.829
2303	JORGE BASADRE	0.60	0.80	0.40	0.40	-0.232	-0.245	-0.628	-0.624
2304	TARATA	160.10	191.80	111.90	74.90	-0.340	-0.290	-0.567	-0.829
2401	TUMBES	217.10	680.00	391.20	370.10	-0.366	0.919	0.235	0.535
2402	CONTRALMIRANTE VILLAR	93.00	309.50	163.80	154.20	-0.345	0.854	0.187	0.583
2403	ZARUMILLA	217.10	680.00	391.20	370.10	-0.366	0.919	0.235	0.535
2501	CORONEL PORTILLO	797.75	1048.97	795.49	722.01	-0.087	0.733	-0.292	-0.342
2502	ATALAYA	985.78	1241.70	1058.31	1046.55	-0.403	0.605	-0.242	-0.003
2503	PADRE ABAD	1282.00	1776.54	1609.59	1743.10	-0.529	0.208	-0.060	0.323
2504	PURUS	1119.77	1167.30	1196.90	1693.23	-0.072	0.078	0.218	2.056

Annex 5: Third/Fourth Grid Characteristics – Latitude, Longitude, and Sum of Monthly Precipitation (2007-2010)

Province Code	Province	Latitude (Grid 3-4)	Longitude (Grid 3-4)	Sum of Monthly Precipitation (Dec-Mar 2007)	Sum of Monthly Precipitation (Dec-Mar 2008)	Sum of Monthly Precipitation (Dec-Mar 2009)	Sum of Monthly Precipitation (Dec-Mar 2010)
0101	CHACHAPOYAS	-5.75	-78.25	461.6	560.8	533.6	464.8
0102	BAGUA	-5.25	-78.75	464.5	687	601.6	526
0103	BONGARA	-6.25	-78.25	490.2	566.5	561.8	454
0104	CONDORCANQUI	-4.25	-78.25	632.9	968.4	803.8	797.5
0105	LUYA	-5.75	-78.25	461.6	560.8	533.6	464.8
0106	RODRIGUEZ DE MENDOZA	-6.75	-77.75	635.3	610.2	663.4	485.5
0107	UTCUBAMBA	-6.25	-78.75	430.2	591.9	542.8	419.4
0201	HUARAZ	-9.25	-77.25	406	404.3	645.7	480.1
0202	AIJA	-10.25	-77.25	225.9	205.8	742.3	448.2
0203	ANTONIO RAYMONDI	-8.75	-76.75	465.5	485.9	634.8	455.8
0204	ASUNCION	-8.75	-77.75	496.8	511.5	817.4	422.3
0205	BOLOGNESI	-9.75	-76.75	346.8	368.7	585.3	558.7
0206	CARHUAZ	-9.75	-77.25	303.8	304.2	631.1	453.2
0207	CARLOS FERMIN FITZCARRALD	-8.75	-77.75	496.8	511.5	817.4	422.3
0208	CASMA	-9.75	-77.75	208.3	201.7	512.2	249
0209	CORONGO	-8.25	-78.25	523.6	549.3	718	356.9
0210	HUARI	-9.75	-76.75	346.8	368.7	585.3	558.7
0211	HUARMEY	-9.75	-77.75	208.3	201.7	512.2	249
0212	HUAYLAS	-8.75	-78.25	230.5	270.8	413.4	186.1
0213	MARISCAL LUZURIAGA	-9.25	-77.75	403.2	403.3	757.7	441.3
0214	OCROS	-10.75	-77.75	13.7	7.6	63.1	23.8
0215	PALLASCA	-8.75	-77.75	496.8	511.5	817.4	422.3
0216	POMABAMBA	-9.25	-77.75	403.2	403.3	757.7	441.3
0217	RECUAY	-9.25	-77.75	403.2	403.3	757.7	441.3
0218	SANTA	-8.75	-78.25	230.5	270.8	413.4	186.1
0219	SIHUAS	-8.25	-77.25	548.3	508.8	647.3	393.7
0220	YUNGAY	-8.75	77.25	413.4	407.2	587.4	372.6
0301	ABANCAY	-13.25	-73.25	487.2	451.6	408.2	532.5
0302	ANDAHUAYLAS	-13.25	-73.75	493.5	443.7	440.3	606.2
0303	ANTABAMBA	-14.75	-73.25	481.1	602.4	466.5	454.5
0304	AYMARAES	-14.75	-72.75	474.2	629.3	452.2	432.2
0305	COTABAMBAS	-14.25	-71.75	540.7	697.6	485.4	485.4
0306	CHINCHEROS	-13.25	-73.25	487.2	451.6	408.2	532.5
0307	GRAU	-13.75	-72.25	477.4	570.2	423.1	459.6
0401	AREQUIPA	-16.75	-71.75	6.2	9.9	5.5	2.3
0402	CAMANA	-16.25	-72.25	13.4	20.5	11.8	8.4
0403	CARAVELI	-16.25	-73.75	0.1	0.1	0.2	0.1
0404	CASTILLA	-15.75	-72.75	181.7	285.2	179.8	146.4
0405	CAYLLOMA	-15.25	-71.25	440	578.2	400.2	363
0406	CONDESUYOS	-16.25	-72.25	13.4	20.5	11.8	8.4
0407	ISLAY	-16.75	-72.25	0.7	1.1	0.5	0.3
0408	LA UNION	-14.75	-73.25	481.1	602.4	466.5	454.5
0501	HUAMANGA	-12.75	-73.75	462.4	397.3	422.7	600.6
0502	CANGALLO	-13.25	-73.75	493.5	443.7	440.3	606.2
0503	HUANCA SANCOS	-14.25	-74.75	350.6	338.5	376.9	425.3

0504	HUANTA	-13.25	-73.75	493.5	443.7	440.3	606.2
0505	LA MAR	-12.75	-74.25	416.5	363.4	445.8	623.7
0506	LUCANAS	-14.25	-73.75	515.3	545.3	476.4	528.8
0507	PARINACOCHAS	-14.75	-74.25	414.4	452.5	407.3	423.2
0508	PAUCAR DEL SARA SARA	-15.75	-73.75	72.7	107.6	78.7	61.9
0509	SUCRE	-13.75	-74.25	511.1	470.5	504.1	650.8
0510	VICTOR FAJARDO	-14.25	-73.75	515.3	545.3	476.4	528.8
0511	VILCAS HUAMAN	-13.25	-74.25	473.2	417.2	482.2	660.1
0601	CAJAMARCA	-6.75	-78.25	601.2	632.7	667.4	498.2
0602	CAJABAMBA	-7.25	-77.75	687.8	609.6	697.8	473.5
0603	CELENDIN	-7.25	-77.75	687.8	609.6	697.8	473.5
0604	CHOTA	-6.25	-78.25	490.2	566.5	561.8	454
0605	CONTUMAZA	-7.75	-79.25	29.8	69.2	63.2	32.3
0606	CUTERVO	-6.75	-79.25	281.6	540.3	446.9	301
0607	HUALGAYOC	-6.25	-78.25	490.2	566.5	561.8	454
0608	JAEN	-5.25	-79.25	403.7	716.9	571.7	494
0609	SAN IGNACIO	-4.75	-78.75	509.3	788.2	657.8	625.3
0610	SAN MARCOS	-7.75	-77.75	688.1	612.8	760	450.3
0611	SAN MIGUEL	-6.75	-79.25	281.6	540.3	446.9	301
0612	SAN PABLO	-6.75	-79.25	281.6	540.3	446.9	301
0613	SANTA CRUZ	-6.25	-79.25	401.9	752.7	603.7	454
0701	CALLAO	-11.75	-76.75	59	0.3	259.1	217.9
0801	CUSCO	-13.25	-72.25	501.1	519.2	430.8	508
0802	ACOMAYO	-14.25	-71.25	512.8	633.3	461.3	457.5
0803	ANTA	-13.75	-72.75	471.3	419.9	419.9	468.6
0804	CALCA	-13.75	-72.25	477.4	570.2	424.1	459.6
0805	CANAS	-13.75	-71.75	479.8	569.2	417.5	452
0806	CANCHIS	-13.75	-70.75	507.8	560.9	472.2	509.8
0807	CHUMBIVILCAS	-14.75	-71.75	507.2	673.4	466.5	438.6
0808	ESPINAR	-14.75	-71.75	507.2	673.4	466.5	438.6
0809	LA CONVENCION	-13.25	-72.25	501.1	519.2	430.8	508
0810	PARURO	-14.25	-72.25	513.3	668.4	468.5	472.1
0811	PAUCARTAMBO	-13.75	-71.25	507.2	579.1	447.2	476.6
0812	QUISPICANCHI	-13.25	-71.25	807	805.2	705.5	857.1
0813	URUBAMBA	-13.75	-72.75	471.3	419.9	419.9	468.6
0901	HUANCAVELICA	-13.25	-75.25	281.9	197.9	448.2	726.7
0902	ACOBAMBA	-13.25	-74.25	473.1	417.2	482.2	660.1
0903	ANGARAES	-13.25	-74.25	473.1	417.2	482.2	660.1
0904	CASTROVIRREYNA	-13.75	-75.75	22.2	13.6	67.5	21.4
0905	CHURCAMPA	-12.25	-75.75	180.1	36.8	520	1039.3
0906	HUAYTARA	-13.25	-75.75	108.6	45.4	322.4	314.5
0907	TAYACAJA	-12.75	-75.25	257.9	156.3	441.6	879.5
1001	HUANUCO	-10.25	-75.75	409.3	488.8	568.1	785.6
1002	AMBO	-9.75	-75.75	566	744.8	790.1	1033.3
1003	DOS DE MAYO	-10.25	-77.25	225.9	205.8	742.3	448.2
1004	HUACAYBAMBA	-8.75	-77.25	413.4	407.2	587.4	372.6
1005	HUAMALIES	-9.25	-77.25	406	404.3	645.7	480.1
1006	LEONCIO PRADO	-9.75	-75.75	566	744.8	790.1	1033.3
1007	MARAÑON	-8.25	-76.75	804.5	808.9	1020.2	643.7
1008	PACHITEA	-10.25	-76.25	287.6	325.8	478.5	669
1009	PUERTO INCA	-9.75	-75.25	1129.3	1672.5	1531.5	1954.5
1010	LAURICOCHA	-9.75	-76.25	276.4	317.5	411.3	468.7
1011	YAROWILCA	-10.25	-76.25	287.6	325.8	478.5	669
1101	ICA	-13.75	-75.25	254.9	203.4	374.5	416.4
1102	CHINCHA	-13.75	-75.75	22.2	13.6	67.5	21.4
1103	NAZCA	-15.25	-74.25	137.9	158.9	142.6	136.4
1104	PALPA	-14.25	-74.75	350.6	338.5	376.9	425.3

1105	PISCO	-13.25	-75.75	254.9	203.4	374.5	416.4
1201	HUANCAYO	-11.75	-74.75	390.4	344.7	525.8	867.8
1202	CONCEPCION	-12.25	-75.75	180.1	36.8	520	1039.3
1203	CHANCHAMAYO	-10.75	-75.75	344.8	385	577.5	959.2
1204	JAUJA	-12.25	-75.25	242.3	132.7	454.4	981.7
1205	JUNIN	-10.75	-76.25	266.1	264.8	541.6	967.7
1206	SATIPO	-11.75	-74.25	642.6	618	694.5	913.8
1207	TARMA	-11.75	-75.25	259.6	185.3	490.2	992
1208	YAULI	-11.25	-76.25	195.5	124.1	489.3	1050.7
1209	CHUPACA	-11.75	-75.75	156.6	68.9	429	886.2
1301	TRUJILLO	-7.75	-78.75	307.4	439.5	484.3	247.1
1302	ASCOPE	-7.25	-78.75	526.7	664.7	717.4	421.9
1303	BOLIVAR	-6.75	-77.25	684.4	621.9	694.5	484.9
1304	CHEPEN	-6.75	-79.75	30.3	99.1	57	45.7
1305	JULCAN	-7.75	-78.75	307.4	439.5	484.3	247.1
1306	OTUZCO	-8.25	-78.25	523.6	549.3	718	356.9
1307	PACASMAYO	-7.75	-79.25	29.8	69.2	63.2	32.3
1308	PATAZ	-8.75	-77.75	496.8	511.5	817.4	422.3
1309	SANCHEZ CARRION	-8.25	-77.75	613.6	589.3	809.3	421.3
1310	SANTIAGO DE CHUCO	-7.75	-78.75	307.4	439.5	484.3	247.1
1311	GRAN CHIMU	-7.75	-79.25	29.8	69.2	63.2	32.3
1312	VIRU	-8.75	-78.25	230.5	270.8	413.4	186.1
1401	CHICLAYO	-7.25	-79.25	137.6	300.3	267.8	148.5
1402	FERREÑAFE	-6.25	-79.25	401.9	752.7	603.7	454
1403	LAMBAYEQUE	-6.25	-80.25	25.2	112.1	42.5	47.2
1501	LIMA	-11.75	-76.75	59	0.3	259.1	217.9
1502	BARRANCA	-11.25	-77.25	22	3	111.5	24.4
1503	CAJATAMBO	-10.75	-77.25	118.9	69.4	514.5	258.5
1504	CANTA	-11.75	-76.25	148	22.9	489	932.1
1505	CAÑETE	-12.75	-76.75	0.8	0	11	4.1
1506	HUARAL	-11.75	-76.75	59	0.3	259.1	217.9
1507	HUAROCHIRI	-12.25	-76.75	13.7	0	81.6	27
1508	HUAURA	-10.75	-77.25	118.9	69.4	514.5	258.5
1509	OYON	-10.25	-77.25	225.9	205.8	742.3	448.2
1510	YAUYOS	-12.75	-76.25	45.9	4.5	203.2	158.3
1601	MAYNAS	-3.25	-72.75	1957.3	2118.1	1439	1223.5
1602	ALTO AMAZONAS	-6.25	-75.75	877.1	875.1	762.6	793
1603	LORETO	-4.25	-73.25	1681.9	1869.2	1199.1	1036.9
1604	MARISCAL RAMON CASTILLA	-4.25	-70.25	1618.9	1641	1828.2	1426.3
1605	REQUENA	-4.75	-74.25	1419.4	1463.6	977.4	974.7
1606	UCAYALI	-7.75	-74.75	781.3	949.4	751.1	719.4
1607	DATEM DEL MARAÑON	-5.25	-76.25	936.3	855.5	775.7	908.4
1608	PUTUMAYO	-2.75	-72.25	1692.8	1797.3	1322.7	1116.1
1701	TAMBOPATA	-12.25	-68.75	953.6	1064.9	1123.2	1487.8
1702	MANU	-13.25	-71.75	512.3	523.2	440.9	523.8
1703	TAHUAMANU	-11.25	-69.25	920	979.1	1024.4	1547.5
1801	MARISCAL NIETO	-16.75	-71.25	47.7	75.6	43.6	20.6
1802	GENERAL SANCHEZ CERRO	-16.25	-71.25	196.4	270.1	177.3	100.5
1803	ILO	-17.25	-71.75	7.4	15.6	5.8	3.7
1901	PASCO	-10.25	-76.75	267.3	273.8	613	671
1902	DANIEL ALCIDES CARRION	-10.75	-76.25	266.1	264.8	541.6	967.7
1903	OXAPAMPA	-10.25	-75.75	409.3	488.8	568.1	785.6
2001	PIURA	-4.75	-80.25	131.6	511.3	252.7	252.7

2002	AYABACA	-4.25	-79.25	411.6	966	652.7	722.1
2003	HUANCABAMBA	-4.75	-79.75	378.3	1075.2	664.4	602.9
2004	MORROPON	-4.75	-79.75	378.3	1075.2	664.4	602.9
2005	PAITA	-4.75	-80.75	41.4	180.5	74.8	73.4
2006	SULLANA	-5.25	-80.25	71.5	299.5	145.2	123.5
2007	TALARA	-4.25	-80.75	103.8	409.5	197.2	179.5
2008	SECHURA	-5.25	-81.25	8.1	30.1	12.4	14.9
2101	PUNO	-16.25	-69.75	429	502.7	389.8	310.3
2102	AZANGARO	-15.25	-69.75	404.3	494	424	389.5
2103	CARABAYA	-13.75	-70.75	507.8	560.9	472.2	509.8
2104	CHUCUITO	-15.75	-69.75	404.3	494	424	389.5
2105	EL COLLAO	-15.75	-69.25	468.8	539.4	466.9	393.9
2106	HUANCANE	-14.75	-70.25	424.6	494.9	421.3	407.4
2107	LAMPA	-15.75	-70.75	405.2	533.6	370.4	296.8
2108	MELGAR	-15.25	-70.25	398	499	399.8	375.8
2109	MOHO	-15.75	-69.75	404.3	494	424	389.5
2110	SAN ANTONIO DE PUTINA	-15.25	-70.25	398	499	399.8	375.8
2111	SAN ROMAN	-15.75	-69.75	404.3	494	424	389.5
2112	SANDIA	-14.75	-69.75	407.3	472.5	431.5	409
2113	YUNGUYO	-15.75	-68.75	386.3	376.5	380.7	331.3
2201	MOYOBAMBA	-5.75	-77.25	719	744.8	762.4	650.2
2202	BELLAVISTA	-6.75	-76.25	474.3	482.9	496.5	407.2
2203	EL DORADO	-6.25	-76.25	702.9	656.9	726.9	544.5
2204	HUALLAGA	-7.25	-76.25	574.9	602.8	635.6	496.2
2205	LAMAS	-6.75	-76.25	474.3	482.9	496.5	407.2
2206	MARISCAL CACERES	-6.75	-76.25	474.3	482.9	496.5	407.2
2207	PICOTA	-7.25	-76.75	688.1	644.6	746.6	512.7
2208	RIOJA	-5.75	-76.75	815.1	780	819.9	728.2
2209	SAN MARTIN	-6.75	-76.75	582.5	540.6	620.5	430.6
2210	TOCACHE	-7.75	-76.25	845.3	912.5	991.1	736.3
2301	TACNA	-17.75	-69.75	170.1	178.9	103.8	83.8
2302	CANDARAVE	-17.75	-70.75	0.6	0.8	0.4	0.4
2303	JORGE BASADRE	-17.25	-71.25	0.3	0.6	0.3	0.1
2304	TARATA	-17.75	-69.75	170.1	178.9	103.8	83.8
2401	TUMBES	-3.25	-79.75	295.3	794.3	480.8	516.9
2402	CONTRALMIRANTE VILLAR	-3.25	-80.25	195.4	546.8	325.5	333.1
2403	ZARUMILLA	-3.25	-79.75	295.3	794.3	480.8	516.9
2501	CORONEL PORTILLO	-8.75	-74.25	838.8	1249	893.9	726.3
2502	ATALAYA	-10.25	-74.25	899.5	1389.9	1121.6	1151.9
2503	PADRE ABAD	-8.75	-75.25	1567.2	2067.9	1636.4	1541.6
2504	PURUS	-10.25	-70.25	1072.2	1114	1206.2	1834.3

Annex 6: Provinces Characteristics – Population, Immigration, Emigration, Migration Balance, and Intra-Province Migration by Year

Province Code	Province	Year	Population	Immigration	Emigration	Migration Balance	Intra-Province Migration
0101	CHACHAPOYAS	2007	63513.43	15172.08	38684.71	-23512.63	5916.38
0101	CHACHAPOYAS	2008	68163.70	15945.85	47826.16	-31880.31	5619.04
0101	CHACHAPOYAS	2009	75251.31	16604.54	39663.01	-23058.47	6822.8
0101	CHACHAPOYAS	2010	70672.44	13744.96	53130.47	-39385.51	7574.18
0102	BAGUA	2007	98062.20	35672.49	28258.79	7413.7	4779.08
0102	BAGUA	2008	107659.38	39463.42	28453.11	11010.31	3989.52
0102	BAGUA	2009	119494.69	36755.19	27400.18	9355.01	6791.36
0102	BAGUA	2010	113192.41	37472.32	27911.87	9560.45	6394.58
0103	BONGARA	2007	28206.09	14212.01	4334.43	9877.58	1354.24
0103	BONGARA	2008	32803.23	17069.12	6139.59	10929.53	1304.26
0103	BONGARA	2009	30342.41	15521.37	9777.06	5744.31	744.33
0103	BONGARA	2010	32751.44	14734.7	9643.97	5090.73	1139.27
0104	CONDORCANQUI	2007	37873.20	1849.09	1822.81	26.28	1935.53
0104	CONDORCANQUI	2008	48879.93	560.28	1878.12	-1317.84	844.18
0104	CONDORCANQUI	2009	42147.82	648.32	2307.82	-1659.5	1089.7
0104	CONDORCANQUI	2010	42835.81	114.43	1574.37	-1459.94	1426.94
0105	LUYA	2007	45650.11	5321.28	30394.37	-25073.09	1903.17
0105	LUYA	2008	47000.66	8167.88	32818.98	-24651.1	2090.07
0105	LUYA	2009	47477.97	7837.25	34880.93	-27043.68	3116.91
0105	LUYA	2010	49434.70	6760.11	31208.31	-24448.2	2438.79
0106	RODRIGUEZ DE MENDOZA	2007	28639.87	8542.81	11256.54	-2713.73	4023.29
0106	RODRIGUEZ DE MENDOZA	2008	25360.90	8201.74	9877.64	-1675.9	3395.45
0106	RODRIGUEZ DE MENDOZA	2009	27172.57	8166.15	8262.04	-95.89	3306.6
0106	RODRIGUEZ DE MENDOZA	2010	30335.44	9938.28	15491.02	-5552.74	4469
0107	UTCUBAMBA	2007	137143.16	52653.29	40359.6	12293.69	8252.7
0107	UTCUBAMBA	2008	136911.98	52554	46028.22	6525.78	5480.89
0107	UTCUBAMBA	2009	137455.85	50637.22	43003.37	7633.85	5665.45
0107	UTCUBAMBA	2010	144513.11	52453.05	45141.16	7311.89	7456.66
0201	HUARAZ	2007	175611.80	41181.19	111623.2	-70442.01	15204.82
0201	HUARAZ	2008	164031.59	44865.24	111851.7	-66986.46	17207.65
0201	HUARAZ	2009	168943.01	36893.44	112126.8	-75233.36	22425.17
0201	HUARAZ	2010	183374.28	42126.58	113289.4	-71162.82	31883.19
0202	AIJA	2007	.	.	12675.22	.	.
0202	AIJA	2008	.	.	10858.51	.	.
0202	AIJA	2009	.	.	11664.65	.	.
0202	AIJA	2010	.	.	5206.18	.	.
0203	ANTONIO RAYMONDI	2007	8244.06	.	11458.79	.	499.64
0203	ANTONIO RAYMONDI	2008	7407.47	.	14100.03	.	.
0203	ANTONIO RAYMONDI	2009	6847.20	.	10092.3	.	507.2
0203	ANTONIO RAYMONDI	2010	6885.76	.	14241.67	.	491.84
0204	ASUNCION	2007	20380.53	4677.54	6875.24	-2197.7	764.21
0204	ASUNCION	2008	19413.29	1761.93	8838.62	-7076.69	504.39
0204	ASUNCION	2009	14226.92	2412.04	5239.12	-2827.08	1199.16
0204	ASUNCION	2010	16428.71	3196.86	15455.06	-12258.2	718.95
0205	BOLOGNESI	2007	58142.81	8972.69	26429.69	-17457	259.22
0205	BOLOGNESI	2008	59919.67	13074.94	43166.75	-30091.81	2394.67
0205	BOLOGNESI	2009	56690.60	17379.57	38329.19	-20949.62	477.04
0205	BOLOGNESI	2010	60377.43	8738.46	42203.73	-33465.27	1233.14

0206	CARHUAZ	2007	12192.70	259.22	18440.48	-18181.26	.
0206	CARHUAZ	2008	14962.81	253.79	21303.4	-21049.61	253.79
0206	CARHUAZ	2009	16524.14	486.38	21564.94	-21078.56	241.06
0206	CARHUAZ	2010	15446.85	730.58	29928.03	-29197.45	490.93
0207	CARLOS FERMIN FITZCARRALD	2007	27221.77	1997.09	15585.14	-13588.05	748.83
0207	CARLOS FERMIN FITZCARRALD	2008	30052.96	1526.31	11548.71	-10022.4	760.02
0207	CARLOS FERMIN FITZCARRALD	2009	27523.40	2249.28	13911.11	-11661.83	989.56
0207	CARLOS FERMIN FITZCARRALD	2010	21496.75	725.22	11042.92	-10317.7	.
0208	CASMA	2007	49372.96	16604.42	16642.2	-37.78	9322.24
0208	CASMA	2008	48374.00	16558.12	16460.43	97.69	8715.08
0208	CASMA	2009	58111.36	16564.87	22797.04	-6232.17	8709.62
0208	CASMA	2010	71506.74	18531.36	25730.87	-7199.51	6024.89
0209	CORONGO	2007	.	.	9205.99	.	.
0209	CORONGO	2008	.	.	12737.94	.	.
0209	CORONGO	2009	.	.	8694.38	.	.
0209	CORONGO	2010	.	.	7225.62	.	.
0210	HUARI	2007	80605.36	7077	82317.07	-75240.07	5295.84
0210	HUARI	2008	79702.50	3791.97	79260.62	-75468.65	4104.58
0210	HUARI	2009	95678.89	8884.17	82583.41	-73699.24	8088.2
0210	HUARI	2010	87302.53	9978	91686.69	-81708.69	10207.7
0211	HUARMEY	2007	16982.97	6452.69	10633.38	-4180.69	3161.52
0211	HUARMEY	2008	20895.69	7484.36	21504.69	-14020.33	1302.27
0211	HUARMEY	2009	24653.17	4614.65	16181.58	-11566.93	1358.78
0211	HUARMEY	2010	24170.96	4946.03	15737.71	-10791.68	2886.16
0212	HUAYLAS	2007	51865.14	11042.33	61825.22	-50782.89	2892.87
0212	HUAYLAS	2008	57259.27	5660.18	38263.55	-32603.37	2443.2
0212	HUAYLAS	2009	56733.26	10112.76	46530.34	-36417.58	5006.85
0212	HUAYLAS	2010	55363.22	7198.51	35636.05	-28437.54	5781.23
0213	MARISCAL LUZURIAGA	2007	29204.37	499.22	16707.98	-16208.76	.
0213	MARISCAL LUZURIAGA	2008	30147.46	506.68	12614.84	-12108.16	506.68
0213	MARISCAL LUZURIAGA	2009	31400.96	1226.6	21339.07	-20112.47	245.32
0213	MARISCAL LUZURIAGA	2010	28758.00	1437.9	16488.67	-15050.77	.
0214	OCROS	2007	9204.60	5078.4	13585.13	-8506.73	317.4
0214	OCROS	2008	13497.27	6277.8	8652.93	-2375.13	313.89
0214	OCROS	2009	12474.40	5925.34	4092.14	1833.2	.
0214	OCROS	2010	9395.52	7633.86	4178.07	3455.79	.
0215	PALLASCA	2007	29176.28	1972.8	28630.95	-26658.15	1482.2
0215	PALLASCA	2008	33446.20	1015.18	30689.84	-29674.66	241.24
0215	PALLASCA	2009	33120.10	770.41	36698.02	-35927.61	462.02
0215	PALLASCA	2010	33520.80	1480.88	42632.62	-41151.74	748.48
0216	POMABAMBA	2007	23012.42	1507.27	29258.91	-27751.64	.
0216	POMABAMBA	2008	28140.09	2787.19	22699.2	-19912.01	506.68
0216	POMABAMBA	2009	30456.26	1712.98	17675.7	-15962.72	490.64
0216	POMABAMBA	2010	31063.57	1940.46	20827.98	-18887.52	958.6
0217	RECUAY	2007	21039.27	1272.14	18584.05	-17311.91	506.46
0217	RECUAY	2008	18111.31	1703.93	31509.99	-29806.06	717.81
0217	RECUAY	2009	17634.34	1463.4	25991.56	-24528.16	735.96
0217	RECUAY	2010	21459.06	3138.71	31090.02	-27951.31	1202.05
0218	SANTA	2007	437094.80	145198.3	76460.93	68737.37	85386.7
0218	SANTA	2008	449510.84	142416.4	93040.06	49376.34	80603.27
0218	SANTA	2009	465215.92	144241.7	79738.4	64503.3	90851.92
0218	SANTA	2010	454875.11	136034.1	103040.5	32993.6	104400.4
0219	SIHUAS	2007	35403.35	259.49	26307.19	-26047.7	783.97
0219	SIHUAS	2008	36093.62	1260.9	28815.78	-27554.88	1005.88

0219	SIHUAS	2009	40119.44	2153.1	30975.16	-28822.06	476.94
0219	SIHUAS	2010	39588.24	1229.11	21162.39	-19933.28	981.63
0220	YUNGAY	2007	56233.38	9649.01	16415.97	-6766.96	2125.75
0220	YUNGAY	2008	55542.06	15056.21	24231.05	-9174.84	1940.69
0220	YUNGAY	2009	55214.51	12547.23	35318.77	-22771.54	2805.27
0220	YUNGAY	2010	53340.32	11454.67	17259.36	-5804.69	4574.79
0301	ABANCAY	2007	111598.00	23612.61	78981.35	-55368.74	13572.05
0301	ABANCAY	2008	120183.20	28425.51	62945.95	-34520.44	11566.76
0301	ABANCAY	2009	115822.96	24024.66	67400.01	-43375.35	18823.87
0301	ABANCAY	2010	117930.55	22953.21	68730.66	-45777.45	19621.74
0302	ANDAHUAYLAS	2007	156433.89	11226.42	82224.65	-70998.23	9820.63
0302	ANDAHUAYLAS	2008	162894.97	13207.42	77044.46	-63837.04	14823.56
0302	ANDAHUAYLAS	2009	162413.40	13907.33	89734.33	-75827	14711.26
0302	ANDAHUAYLAS	2010	170995.01	12492.66	108103.5	-95610.84	21027.23
0303	ANTABAMBA	2007	14284.40	1643.73	13640.25	-11996.52	.
0303	ANTABAMBA	2008	15156.34	1568.48	10139.17	-8570.69	950.85
0303	ANTABAMBA	2009	13906.77	1068.44	7485.54	-6417.1	151.66
0303	ANTABAMBA	2010	12421.56	932.1	10945.2	-10013.1	.
0304	AYMARAES	2007	36472.28	4698.21	34214.34	-29516.13	1380.26
0304	AYMARAES	2008	39637.69	3795.95	37070.48	-33274.53	1408.32
0304	AYMARAES	2009	39341.45	3205.17	24965.24	-21760.07	1845.25
0304	AYMARAES	2010	44454.66	4974.24	35995.56	-31021.32	3739.94
0305	COTABAMBAS	2007	33680.51	1981.17	22702.31	-20721.14	.
0305	COTABAMBAS	2008	35385.22	640.75	19078.16	-18437.41	.
0305	COTABAMBAS	2009	33973.23	1238.81	31064.68	-29825.87	306.16
0305	COTABAMBAS	2010	36239.87	1220.92	17124.79	-15903.87	149.09
0306	CHINCHEROS	2007	63549.05	8355.28	29810.68	-21455.4	2773.36
0306	CHINCHEROS	2008	65636.75	5252.58	20225.18	-14972.6	2509.44
0306	CHINCHEROS	2009	67705.75	2755.16	26582.27	-23827.11	4120.82
0306	CHINCHEROS	2010	67832.37	6090.57	21053.93	-14963.36	3602.98
0307	GRAU	2007	44259.06	4686.73	13757.47	-9070.74	2076.14
0307	GRAU	2008	46049.57	3576.64	14106.98	-10530.34	5233.04
0307	GRAU	2009	43209.72	7415.6	23334.17	-15918.57	942.84
0307	GRAU	2010	44678.71	5594.17	18720.98	-13126.81	4630.83
0401	AREQUIPA	2007	897276.61	328754.8	161652.4	167102.4	397032.8
0401	AREQUIPA	2008	947129.15	300227.8	183542.3	116685.5	426915
0401	AREQUIPA	2009	952529.97	326243.8	167414.5	158829.3	421674.6
0401	AREQUIPA	2010	964612.37	326673.7	183870	142803.7	423838.4
0402	CAMANA	2007	51889.30	22786.9	19246.35	3540.55	12815.59
0402	CAMANA	2008	53466.02	22668.73	21003.67	1665.06	12665.67
0402	CAMANA	2009	59532.42	24703.42	22140.1	2563.32	14839.01
0402	CAMANA	2010	56704.33	22917.05	18169.41	4747.64	13034.95
0403	CARAVELI	2007	22270.00	8349.47	16098.59	-7749.12	2467.72
0403	CARAVELI	2008	24531.94	10229.58	26706.89	-16477.31	1151.9
0403	CARAVELI	2009	22776.63	6609.91	19928.66	-13318.75	2459.36
0403	CARAVELI	2010	21888.48	9165.12	25564.67	-16399.55	1958
0404	CASTILLA	2007	40308.20	13383.23	30052.32	-16669.09	3470.54
0404	CASTILLA	2008	38243.37	12132.61	28608.69	-16476.08	2755.18
0404	CASTILLA	2009	43422.11	15607.29	35278.17	-19670.88	4150.73
0404	CASTILLA	2010	46356.12	14581.66	24485.09	-9903.43	3376.86
0405	CAYLLOMA	2007	76851.41	24173.37	33732.23	-9558.86	17915.66
0405	CAYLLOMA	2008	81855.51	28399.82	30141.79	-1741.97	16076.8
0405	CAYLLOMA	2009	85256.10	30187.76	40112.9	-9925.14	18978.05
0405	CAYLLOMA	2010	90154.66	29831.97	34432.64	-4600.67	18987.9
0406	CONDESUYOS	2007	47012.21	14635.18	22139.27	-7504.09	7685.16
0406	CONDESUYOS	2008	41944.37	15097.09	24588.81	-9491.72	5483.19
0406	CONDESUYOS	2009	40785.36	17454.93	22603.92	-5148.99	4521
0406	CONDESUYOS	2010	47500.94	17960.28	17634.74	325.54	3188.03

0407	ISLAY	2007	72409.84	27775.33	39680.62	-11905.29	14290.66
0407	ISLAY	2008	83587.28	37914.58	35257.7	2656.88	18090.13
0407	ISLAY	2009	72174.87	30291.94	30447.7	-155.76	11975.41
0407	ISLAY	2010	78382.84	36523.9	28282.07	8241.83	10450.18
0408	LA UNION	2007	15391.41	859.72	27716.54	-26856.82	805.5
0408	LA UNION	2008	14428.84	181.17	19784.84	-19603.67	368.92
0408	LA UNION	2009	14972.33	377.05	16895.17	-16518.12	379
0408	LA UNION	2010	17841.57	406.44	31848.63	-31442.19	.
0501	HUAMANGA	2007	242812.91	67226.95	102408.1	-35181.15	30292.49
0501	HUAMANGA	2008	271755.08	63034.27	102521.7	-39487.43	49448.6
0501	HUAMANGA	2009	271673.59	68153.07	101567.1	-33414.03	40286.17
0501	HUAMANGA	2010	292012.49	63437.04	99000.8	-35563.76	45193.07
0502	CANGALLO	2007	41236.04	4951.87	44791.22	-39839.35	592.92
0502	CANGALLO	2008	40482.69	3475.57	35532.54	-32056.97	317.82
0502	CANGALLO	2009	43959.00	6344.94	48725.98	-42381.04	458.55
0502	CANGALLO	2010	38247.52	5209.08	49732.48	-44523.4	1071.48
0503	HUANCA SANCOS	2007	7997.64	.	15853.66	.	.
0503	HUANCA SANCOS	2008	7947.42	.	5122.13	.	143.62
0503	HUANCA SANCOS	2009	11868.58	481.41	10579.21	-10097.8	.
0503	HUANCA SANCOS	2010	11537.11	454.22	6547.08	-6092.86	.
0504	HUANTA	2007	92480.30	8957	39353.56	-30396.56	12869.94
0504	HUANTA	2008	98352.93	8548.79	49171.76	-40622.97	14174.37
0504	HUANTA	2009	93529.64	6358.5	46607.61	-40249.11	14658.28
0504	HUANTA	2010	103510.05	12309.85	50810.1	-38500.25	12403.66
0505	LA MAR	2007	78618.13	9643.58	39394.69	-29751.11	11301.54
0505	LA MAR	2008	78594.13	9974.29	39799.94	-29825.65	11251.43
0505	LA MAR	2009	78719.52	11684.79	39365.49	-27680.7	12693.64
0505	LA MAR	2010	79214.69	14508.27	31325.29	-16817.02	10293.01
0506	LUCANAS	2007	60035.13	7669.61	64964.05	-57294.44	1641.89
0506	LUCANAS	2008	59242.40	8556.75	86684.14	-78127.39	4662.3
0506	LUCANAS	2009	63696.54	7723.57	78824.08	-71100.51	3755.99
0506	LUCANAS	2010	66148.20	5759.26	90281.38	-84522.12	4284.21
0507	PARINACOCHAS	2007	31962.89	2343.82	27069.03	-24725.21	250.07
0507	PARINACOCHAS	2008	36795.60	5247.76	26492.55	-21244.79	1844.94
0507	PARINACOCHAS	2009	38981.88	4091.98	26016.17	-21924.19	2450.24
0507	PARINACOCHAS	2010	37663.07	6159.84	29093.33	-22933.49	767.12
0508	PAUCAR DEL SARA SARA	2007	7533.35	594.66	16680.81	-16086.15	.
0508	PAUCAR DEL SARA SARA	2008	7810.59	808.46	13928.58	-13120.12	992.94
0508	PAUCAR DEL SARA SARA	2009	8098.59	2082.87	11970.3	-9887.43	477.57
0508	PAUCAR DEL SARA SARA	2010	8138.68	1535.6	10013.42	-8477.82	153.56
0509	SUCRE	2007	15392.58	607.6	10065.14	-9457.54	607.6
0509	SUCRE	2008	15619.24	1861.86	9855.38	-7993.52	1083.26
0509	SUCRE	2009	16764.11	1972.33	6354.26	-4381.93	1962.73
0509	SUCRE	2010	17765.28	2733.12	11023.28	-8290.16	1518.4
0510	VICTOR FAJARDO	2007	38946.62	4731.17	35636.32	-30905.15	875.28
0510	VICTOR FAJARDO	2008	35918.70	3116.05	29165.96	-26049.91	607.94
0510	VICTOR FAJARDO	2009	41604.91	3317.06	29577.99	-26260.93	515.66
0510	VICTOR FAJARDO	2010	37700.71	5211.27	39505.17	-34293.9	1309.39
0511	VILCAS HUAMAN	2007	45252.44	4347.72	30124.28	-25776.56	2034.55
0511	VILCAS HUAMAN	2008	44488.69	3449.7	42225.59	-38775.89	296.5
0511	VILCAS HUAMAN	2009	42690.34	5263.66	28407.96	-23144.3	1836.17
0511	VILCAS HUAMAN	2010	47240.43	4802.91	34247.95	-29445.04	2592.41
0601	CAJAMARCA	2007	290894.56	55678.01	98234.72	-42556.71	24079.2
0601	CAJAMARCA	2008	309910.30	45877.69	97057.65	-51179.96	27865.86

0601	CAJAMARCA	2009	320373.52	61327.31	90773.1	-29445.79	36161.2
0601	CAJAMARCA	2010	322748.65	67788.36	105654.1	-37865.74	25113.77
0602	CAJABAMBA	2007	60443.12	4241.8	52901.27	-48659.47	7168.23
0602	CAJABAMBA	2008	60521.44	9328.26	43090.11	-33761.85	8327.25
0602	CAJABAMBA	2009	57722.67	5147.39	48616.98	-43469.59	3767.75
0602	CAJABAMBA	2010	67840.91	4262.34	46336.76	-42074.42	4613.2
0603	CELENDIN	2007	146811.29	15371.17	66733.27	-51362.1	22540.23
0603	CELENDIN	2008	137383.31	10278.46	68277.21	-57998.75	18308.68
0603	CELENDIN	2009	136772.59	15523.78	57561.64	-42037.86	11705.24
0603	CELENDIN	2010	151079.87	18912.77	84178.13	-65265.36	17091.81
0604	CHOTA	2007	169912.95	14178.71	145303.4	-131124.69	10768.91
0604	CHOTA	2008	156508.97	11037.1	165556.3	-154519.2	11041.75
0604	CHOTA	2009	160615.74	13234.2	157093.7	-143859.5	16309.4
0604	CHOTA	2010	175668.40	15722.99	176584.2	-160861.21	11733.63
0605	CONTUMAZA	2007	28563.70	5169.3	22072.35	-16903.05	3495.07
0605	CONTUMAZA	2008	30509.94	5299.5	24826.08	-19526.58	3535.4
0605	CONTUMAZA	2009	35953.60	7116.2	20872.86	-13756.66	3934.55
0605	CONTUMAZA	2010	31638.17	4661.51	21539.88	-16878.37	4304.2
0606	CUTERVO	2007	159916.40	24867.83	108571	-83703.17	7793.35
0606	CUTERVO	2008	186669.15	23515.26	108743.3	-85228.04	6710.22
0606	CUTERVO	2009	191180.30	17596.82	114392.9	-96796.08	10733.1
0606	CUTERVO	2010	208268.05	21389.47	99895.11	-78505.64	10475.76
0607	HUALGAYOC	2007	120797.99	8790.54	58229.97	-49439.43	.
0607	HUALGAYOC	2008	133868.76	14721	55488.19	-40767.19	1014.01
0607	HUALGAYOC	2009	137332.51	5978.56	56055.99	-50077.43	3888.41
0607	HUALGAYOC	2010	145756.04	14577.85	53430.45	-38852.6	3221.53
0608	JAEN	2007	221374.85	58250.49	91690.94	-33440.45	22528.9
0608	JAEN	2008	240029.07	58736.71	105993.1	-47256.39	22323.18
0608	JAEN	2009	257985.54	68491.86	93781.87	-25290.01	17821.74
0608	JAEN	2010	233401.60	64358.45	96903.3	-32544.85	18559.98
0609	SAN IGNACIO	2007	147367.29	39551.73	22345.77	17205.96	10282.05
0609	SAN IGNACIO	2008	149914.90	50864.93	29044.59	21820.34	5757.03
0609	SAN IGNACIO	2009	149326.91	48972.68	32174.92	16797.76	3424.32
0609	SAN IGNACIO	2010	150896.22	48065.05	25347.56	22717.49	6606.37
0610	SAN MARCOS	2007	52869.85	3636.82	38603.35	-34966.53	3294.42
0610	SAN MARCOS	2008	58111.18	4913.06	22798.04	-17884.98	10458.46
0610	SAN MARCOS	2009	54327.54	2767.64	26499.01	-23731.37	10685.01
0610	SAN MARCOS	2010	52846.03	3567.31	34232.33	-30665.02	9272.15
0611	SAN MIGUEL	2007	47196.05	3254.9	46753.15	-43498.25	2278.43
0611	SAN MIGUEL	2008	46984.42	2805.04	39669.66	-36864.62	1753.15
0611	SAN MIGUEL	2009	41952.84	2728.64	58317.32	-55588.68	1023.24
0611	SAN MIGUEL	2010	31615.47	3197.07	38833.29	-35636.22	355.23
0612	SAN PABLO	2007	20926.72	3269.8	13957.73	-10687.93	1634.9
0612	SAN PABLO	2008	25044.75	2003.58	17501.92	-15498.34	1669.65
0612	SAN PABLO	2009	24799.59	4540.77	19688.47	-15147.7	698.58
0612	SAN PABLO	2010	25726.32	2858.48	13688.56	-10830.08	357.31
0613	SANTA CRUZ	2007	45224.21	3390.4	50036.62	-46646.22	1646.24
0613	SANTA CRUZ	2008	42319.06	2800.16	34219.28	-31419.12	1014.12
0613	SANTA CRUZ	2009	47400.04	4707.68	38719.19	-34011.51	1788.04
0613	SANTA CRUZ	2010	48647.91	3203.04	50814.87	-47611.83	1424.87
0701	CALLAO	2007	905963.93	540172.3	267149.5	273022.8	157336.2
0701	CALLAO	2008	955978.29	540137.7	249264.2	290873.5	155076.3
0701	CALLAO	2009	963956.78	563924.6	282445.3	281479.3	151172.2
0701	CALLAO	2010	985806.77	541454.9	236468.6	304986.3	183599
0801	CUSCO	2007	411567.86	168704.1	122360.9	46343.2	127618.5
0801	CUSCO	2008	416473.84	156857.1	139204.2	17652.9	116920.9
0801	CUSCO	2009	424132.34	148855.9	129974	18881.9	137992
0801	CUSCO	2010	409929.48	151124.7	140140.8	10983.9	119490.6

0802	ACOMAYO	2007	39058.15	1582.5	18171.89	-16589.39	973.38
0802	ACOMAYO	2008	46954.25	3404.67	23732.59	-20327.92	1481.19
0802	ACOMAYO	2009	47755.97	6324.67	27750.43	-21425.76	513.44
0802	ACOMAYO	2010	40733.54	4138.67	28531.79	-24393.12	.
0803	ANTA	2007	54234.39	9422.34	43678.06	-34255.72	1604.34
0803	ANTA	2008	67269.86	10726.28	35898.62	-25172.34	2175.66
0803	ANTA	2009	68857.19	9697.34	48241.43	-38544.09	1924.97
0803	ANTA	2010	68782.52	9247.52	42313.23	-33065.71	3179.12
0804	CALCA	2007	40174.06	5612.04	36524.73	-30912.69	6336.58
0804	CALCA	2008	44015.26	3787.75	20969.1	-17181.35	3792.42
0804	CALCA	2009	35423.52	3637.16	25563.38	-21926.22	4604.29
0804	CALCA	2010	41025.22	6719.85	31276.95	-24557.1	3213.02
0805	CANAS	2007	39386.48	3874.08	15322.11	-11448.03	322.84
0805	CANAS	2008	34788.60	2213.82	15612.01	-13398.19	.
0805	CANAS	2009	28775.70	639.46	18534.36	-17894.9	319.73
0805	CANAS	2010	34508.16	1597.6	25056.95	-23459.35	1597.6
0806	CANCHIS	2007	112901.39	18547.92	52569.07	-34021.15	4980.59
0806	CANCHIS	2008	112511.71	17453.73	54685.27	-37231.54	6151.63
0806	CANCHIS	2009	114371.15	14753.05	56242.97	-41489.92	3196.54
0806	CANCHIS	2010	117700.23	21778.38	49611.5	-27833.12	6608.87
0807	CHUMBIVILCAS	2007	100770.33	12999.14	44233.33	-31234.19	8625.86
0807	CHUMBIVILCAS	2008	102457.48	8046.08	30466.98	-22420.9	6866.31
0807	CHUMBIVILCAS	2009	119505.37	8225.44	39336.83	-31111.39	11238.01
0807	CHUMBIVILCAS	2010	125460.85	9656.31	42042.82	-32386.51	10869.15
0808	ESPINAR	2007	73512.04	5842.78	24437.79	-18595.01	10093.67
0808	ESPINAR	2008	68741.73	5036.26	22634.47	-17598.21	7923.37
0808	ESPINAR	2009	64981.75	6764.62	23692.54	-16927.92	8259.72
0808	ESPINAR	2010	73073.40	6438.72	29788.16	-23349.44	10276.3
0809	LA CONVENCION	2007	179181.77	45476.13	54413.91	-8937.78	15959.78
0809	LA CONVENCION	2008	182020.15	51816.67	53026	-1209.33	17100.25
0809	LA CONVENCION	2009	187977.99	50308.63	37257.22	13051.41	22374.72
0809	LA CONVENCION	2010	183164.72	43807.31	35798.94	8008.37	27489.78
0810	PARURO	2007	54323.28	5652.52	31231.32	-25578.8	955.58
0810	PARURO	2008	51442.68	5088.72	27209.64	-22120.92	640.92
0810	PARURO	2009	51406.35	4659.42	29146.82	-24487.4	2050.56
0810	PARURO	2010	45833.38	1918.92	33201.74	-31282.82	1598.68
0811	PAUCARTAMBO	2007	74048.28	9354.51	12168.67	-2814.16	2554.57
0811	PAUCARTAMBO	2008	79532.04	8450.65	13466.92	-5016.27	2972.47
0811	PAUCARTAMBO	2009	83393.48	5112.93	23616.04	-18503.11	2736.75
0811	PAUCARTAMBO	2010	94856.17	7748.14	17816.13	-10067.99	11735.42
0812	QUISPICANCHI	2007	81441.55	15679.97	25539.16	-9859.19	5172.88
0812	QUISPICANCHI	2008	94839.98	12602.73	37469.47	-24866.74	1388.01
0812	QUISPICANCHI	2009	87538.92	16202.27	34474.66	-18272.39	3960.32
0812	QUISPICANCHI	2010	90845.50	14553.98	38945.36	-24391.38	2890.17
0813	URUBAMBA	2007	47606.29	10190.09	23971.25	-13781.16	2406.42
0813	URUBAMBA	2008	48771.16	14068.16	25413.93	-11345.77	2718.17
0813	URUBAMBA	2009	39712.80	7924.97	17332.38	-9407.41	978.96
0813	URUBAMBA	2010	51356.94	16311.05	33245.89	-16934.84	3994.59
0901	HUANCAVELICA	2007	145650.28	8830.39	114513.5	-105683.11	11483.62
0901	HUANCAVELICA	2008	149924.29	7577.39	122589.9	-115012.51	10885.23
0901	HUANCAVELICA	2009	148188.82	10220.47	129901.8	-119681.33	12583.43
0901	HUANCAVELICA	2010	160844.57	14876.47	107466.7	-92590.23	12805.78
0902	ACOBAMBA	2007	58104.85	10377.64	32490.23	-22112.59	2077.74
0902	ACOBAMBA	2008	60521.66	12637.54	34414.38	-21776.84	1256.89
0902	ACOBAMBA	2009	64966.49	12804.76	64265.97	-51461.21	1337.5
0902	ACOBAMBA	2010	66953.72	12189.95	27213.95	-15024	2240.42
0903	ANGARAES	2007	70953.73	7820.38	43987.46	-36167.08	4579.66
0903	ANGARAES	2008	78865.38	7020.19	28935.11	-21914.92	6476.53

0903	ANGARAES	2009	77312.70	8141.98	26278.11	-18136.13	3881.51
0903	ANGARAES	2010	79641.07	9392.27	23113.25	-13720.98	3177.32
0904	CASTROVIRREYNA	2007	30111.94	6334.38	23500.05	-17165.67	1852.54
0904	CASTROVIRREYNA	2008	33996.68	6726.35	20869.52	-14143.17	3386.72
0904	CASTROVIRREYNA	2009	24626.33	4050.17	22761.5	-18711.33	643.41
0904	CASTROVIRREYNA	2010	29368.85	5246.62	40163.97	-34917.35	1981.23
0905	CHURCAMPA	2007	45533.31	2447.66	39574.87	-37127.21	2179.63
0905	CHURCAMPA	2008	50691.12	3410.06	35391.29	-31981.23	4800.2
0905	CHURCAMPA	2009	51095.90	5019.67	33001.87	-27982.2	5045.4
0905	CHURCAMPA	2010	47719.57	3912.15	24994.86	-21082.71	3436.84
0906	HUAYTARA	2007	19342.56	4052.03	23852.39	-19800.36	930.34
0906	HUAYTARA	2008	21160.27	2977.88	30068.54	-27090.66	864.82
0906	HUAYTARA	2009	24389.55	4842.85	24831.1	-19988.25	2114.25
0906	HUAYTARA	2010	21625.38	2960.88	30575.81	-27614.93	1475.22
0907	TAYACAJA	2007	107111.35	8183.6	60153.33	-51969.73	4626.87
0907	TAYACAJA	2008	105579.39	5266.88	55600.96	-50334.08	2691.84
0907	TAYACAJA	2009	112859.40	7638.53	77417.99	-69779.46	3341.43
0907	TAYACAJA	2010	107275.60	7117.37	73830.47	-66713.1	4153.66
1001	HUANUCO	2007	310500.63	82961.52	142215.6	-59254.08	63084.25
1001	HUANUCO	2008	336411.68	94873.83	111383	-16509.17	68077.05
1001	HUANUCO	2009	327229.83	77348.13	125189.1	-47840.97	58713.87
1001	HUANUCO	2010	342455.97	80678.75	132329	-51650.25	57619.57
1002	AMBO	2007	69412.13	23099.97	44127.09	-21027.12	2834.85
1002	AMBO	2008	80087.06	21077.99	53021.18	-31943.19	4729.34
1002	AMBO	2009	85491.31	22733.3	44314.11	-21580.81	6210.13
1002	AMBO	2010	81008.15	22158.34	51315.6	-29157.26	7487.36
1003	DOS DE MAYO	2007	48190.54	2645.91	37692.51	-35046.6	2265.12
1003	DOS DE MAYO	2008	49156.16	2958.45	42146.31	-39187.86	844.97
1003	DOS DE MAYO	2009	49355.23	2308.99	54431.27	-52122.28	2756.83
1003	DOS DE MAYO	2010	50689.69	2982.56	48046.81	-45064.25	426.38
1004	HUACAYBAMBA	2007	26979.66	4989.48	10900.38	-5910.9	414.18
1004	HUACAYBAMBA	2008	29933.40	2339.04	8520.44	-6181.4	841.76
1004	HUACAYBAMBA	2009	28465.63	4363.38	6994.2	-2630.82	417.86
1004	HUACAYBAMBA	2010	28865.04	2357.24	12590.31	-10233.07	1067.3
1005	HUAMALIES	2007	93327.74	7681.65	36930.95	-29249.3	7970.63
1005	HUAMALIES	2008	89442.03	7416.41	53379.35	-45962.94	6819.11
1005	HUAMALIES	2009	98200.31	5138.65	39912.82	-34774.17	9545.07
1005	HUAMALIES	2010	98587.10	6734.94	36173.53	-29438.59	7559.25
1006	LEONCIO PRADO	2007	140339.78	69656.47	52375.7	17280.77	15387.99
1006	LEONCIO PRADO	2008	149853.31	66850.15	39340.24	27509.91	20504.05
1006	LEONCIO PRADO	2009	146188.34	61476.36	49905.63	11570.73	21820.26
1006	LEONCIO PRADO	2010	165414.10	67048.03	61656.57	5391.46	20822.89
1007	MARAÑON	2007	28206.27	1648.68	3079.56	-1430.88	206.31
1007	MARAÑON	2008	28618.52	4732.24	5130.23	-397.99	430.28
1007	MARAÑON	2009	30651.17	3383.34	5403.16	-2019.82	417.86
1007	MARAÑON	2010	24625.42	855.88	10034.83	-9178.95	856.9
1008	PACHITEA	2007	41053.62	2447.52	35109.25	-32661.73	4497.97
1008	PACHITEA	2008	42444.93	2111.86	33722.71	-31610.85	6964.17
1008	PACHITEA	2009	39832.74	1706.34	18454.2	-16747.86	4281.2
1008	PACHITEA	2010	47215.23	2973.98	21982.34	-19008.36	1914.48
1009	PUERTO INCA	2007	29412.10	19362.12	8980.81	10381.31	611.84
1009	PUERTO INCA	2008	27353.63	14205.65	7794	6411.65	3194
1009	PUERTO INCA	2009	29930.61	17698.17	7726.95	9971.22	872.4
1009	PUERTO INCA	2010	28574.99	18209.49	11352.09	6857.4	936.18
1010	LAURICOCHA	2007	43741.74	5237.01	11466.88	-6229.87	2096.46
1010	LAURICOCHA	2008	41876.56	4545.6	22598.42	-18052.82	1515.48
1010	LAURICOCHA	2009	42257.90	2096.15	19866.69	-17770.54	1663.39
1010	LAURICOCHA	2010	48949.78	3416.77	15850.61	-12433.84	1922.52

1011	YAROWILCA	2007	43177.97	3702.82	23696.82	-19994	821.48
1011	YAROWILCA	2008	44021.75	3828.22	22982.06	-19153.84	420.88
1011	YAROWILCA	2009	39431.97	2717.89	25771.57	-23053.68	1041.88
1011	YAROWILCA	2010	40576.72	1061.06	16539.26	-15478.2	1912.8
1101	ICA	2007	307060.50	85144.67	90418.3	-5273.63	127212.3
1101	ICA	2008	313324.50	93353.49	79369.11	13984.38	126569.2
1101	ICA	2009	333478.12	80259.5	92394.57	-12135.07	136142.5
1101	ICA	2010	328933.60	83155.63	80648.97	2506.66	133499.9
1102	CHINCHA	2007	219745.85	29022.94	54436.85	-25413.91	84751.74
1102	CHINCHA	2008	230730.36	28516.96	38399.45	-9882.49	84117.31
1102	CHINCHA	2009	223368.31	30873.57	43057.35	-12183.78	73246.39
1102	CHINCHA	2010	229947.70	35379.83	47273.47	-11893.64	86768.85
1103	NAZCA	2007	53477.70	20495.03	33804.15	-13309.12	8930.86
1103	NAZCA	2008	57186.23	22152.23	33974.39	-11822.16	13721.52
1103	NAZCA	2009	53589.46	23269.41	27080.12	-3810.71	9810.85
1103	NAZCA	2010	60360.37	25646.73	33216.34	-7569.61	10315.49
1104	PALPA	2007	35758.64	18372.42	7426.81	10945.61	2850.11
1104	PALPA	2008	47997.38	20778.66	16656.96	4121.7	6912.66
1104	PALPA	2009	50552.17	27641.49	10279.18	17362.31	2769.48
1104	PALPA	2010	51119.93	18216.39	11511.16	6705.23	4606.82
1105	PISCO	2007	123321.17	34938.33	38107.17	-3168.84	29557
1105	PISCO	2008	126434.18	34496.77	28409.81	6086.96	31339.39
1105	PISCO	2009	137292.14	38963.28	36229.57	2733.71	35179.63
1105	PISCO	2010	133755.01	34832.07	36625.29	-1793.22	35469.59
1201	HUANCAYO	2007	495248.50	193850.1	176312.4	17537.7	75518.6
1201	HUANCAYO	2008	528156.82	200038.1	187997.1	12041	83906.55
1201	HUANCAYO	2009	510422.55	189396.7	176447.2	12949.5	90957
1201	HUANCAYO	2010	539429.57	182042.7	194934.6	-12891.9	94666.19
1202	CONCEPCION	2007	48530.93	3056	56413.39	-53357.39	1274.61
1202	CONCEPCION	2008	48377.16	3951.44	43028.51	-39077.07	654.39
1202	CONCEPCION	2009	53059.03	3767.29	49264.7	-45497.41	2513.35
1202	CONCEPCION	2010	60896.51	8557.26	43954.63	-35397.37	3561.29
1203	CHANCHAMAYO	2007	271679.66	98737.25	57002.14	41735.11	42370.78
1203	CHANCHAMAYO	2008	287869.15	104992.1	50363.3	54628.8	58761.56
1203	CHANCHAMAYO	2009	299995.52	128066.9	56236.45	71830.45	49271.43
1203	CHANCHAMAYO	2010	333218.51	121136.7	48402.93	72733.77	48805.13
1204	JAUJA	2007	124193.34	28281.28	101410.7	-73129.42	26643.85
1204	JAUJA	2008	133335.58	25310.29	119850.5	-94540.21	40100.99
1204	JAUJA	2009	153717.20	32111.85	110400.7	-78288.85	31847.7
1204	JAUJA	2010	132161.60	25066.01	111134.2	-86068.19	28137.55
1205	JUNIN	2007	11323.19	263.33	47383.82	-47120.49	2633.3
1205	JUNIN	2008	12520.19	1181.15	45307.14	-44125.99	4488.37
1205	JUNIN	2009	11468.26	1745.17	36884.56	-35139.39	1495.86
1205	JUNIN	2010	16980.48	3301.76	43016.3	-39714.54	4716.8
1206	SATIPO	2007	130047.80	51605.11	26658.91	24946.2	14785.55
1206	SATIPO	2008	130171.13	44343.87	32556.77	11787.1	15587.93
1206	SATIPO	2009	141875.34	53717.69	29062.92	24654.77	12506.83
1206	SATIPO	2010	141023.33	42426.52	27600.43	14826.09	17503.41
1207	TARMA	2007	112478.13	14853.11	86404.9	-71551.79	15141.43
1207	TARMA	2008	133673.18	16774.7	94554	-77779.3	15292.61
1207	TARMA	2009	139940.84	20757.59	73815.62	-53058.03	13644.78
1207	TARMA	2010	134640.09	19087.32	118993.5	-99906.18	15744.34
1208	YAULI	2007	107816.51	49192.34	69851.71	-20659.37	10266.02
1208	YAULI	2008	94725.26	43612.93	58977.48	-15364.55	7362.16
1208	YAULI	2009	122307.85	46639.37	86081.34	-39441.97	14798.63
1208	YAULI	2010	96756.50	40583.7	77406.6	-36822.9	10883.1
1209	CHUPACA	2007	25912.30	3124.32	17634.73	-14510.41	4195.46
1209	CHUPACA	2008	24444.98	2790.49	19007.52	-16217.03	1398.97

1209	CHUPACA	2009	25390.62	3775.37	22804.93	-19029.56	4231.39
1209	CHUPACA	2010	22620.80	7829.65	22092.3	-14262.65	2807.49
1301	TRUJILLO	2007	907889.34	384143.1	159555.2	224587.9	217709
1301	TRUJILLO	2008	951235.58	362817.3	143421.9	219395.4	228647.1
1301	TRUJILLO	2009	969506.84	377858.2	144632	233226.2	225411.8
1301	TRUJILLO	2010	986668.31	371875.1	153452	218423.1	244180.6
1302	ASCOPE	2007	100883.31	34947.09	50318.74	-15371.65	16803.31
1302	ASCOPE	2008	103737.22	26619.21	54612.21	-27993	21710.56
1302	ASCOPE	2009	118530.17	31212.51	55941.5	-24728.99	9887.06
1302	ASCOPE	2010	108912.30	31530.81	66548.98	-35018.17	15643.48
1303	BOLIVAR	2007	29650.20	3751.07	24282.74	-20531.67	821.86
1303	BOLIVAR	2008	26885.56	3422.32	12321.47	-8899.15	2059.2
1303	BOLIVAR	2009	26630.77	3593.14	25814.97	-22221.83	2464.37
1303	BOLIVAR	2010	27516.72	3752.28	19128.02	-15375.74	833.84
1304	CHEPEN	2007	109932.85	48977.84	36434.32	12543.52	6592.83
1304	CHEPEN	2008	127746.81	49298.38	30788.8	18509.58	6153.24
1304	CHEPEN	2009	120620.35	53197.27	41781.47	11415.8	16637.46
1304	CHEPEN	2010	123056.93	49701.34	51667.61	-1966.27	15057.66
1305	JULCAN	2007	23964.40	2403.92	15087.06	-12683.14	.
1305	JULCAN	2008	28930.78	2359.56	18307.79	-15948.23	383.79
1305	JULCAN	2009	30744.94	2727.51	17812.56	-15085.05	.
1305	JULCAN	2010	32024.10	406.67	17544.94	-17138.27	.
1306	OTUZCO	2007	104895.77	7173.69	81462.23	-74288.54	3014.39
1306	OTUZCO	2008	114613.05	7718.58	71020.34	-63301.76	3032.94
1306	OTUZCO	2009	105995.55	6267.29	85430.2	-79162.91	5041.35
1306	OTUZCO	2010	106044.87	5432.6	76626.18	-71193.58	3719.11
1307	PACASMAYO	2007	119602.76	41581.22	61418.85	-19837.63	4185.67
1307	PACASMAYO	2008	115506.74	38076.06	47464.23	-9388.17	9855.03
1307	PACASMAYO	2009	126557.84	36641.03	44204.3	-7563.27	10093.58
1307	PACASMAYO	2010	163630.80	49851.85	53141.21	-3289.36	15937.52
1308	PATAZ	2007	62476.94	10505.82	41597.97	-31092.15	421.47
1308	PATAZ	2008	58271.12	10590.68	40854.09	-30263.41	870.08
1308	PATAZ	2009	58386.40	8770.54	54520.47	-45749.93	808.04
1308	PATAZ	2010	65694.52	13836.72	39669.05	-25832.33	429.98
1309	SANCHEZ CARRION	2007	136298.55	8254.55	52646.89	-44392.34	17575.09
1309	SANCHEZ CARRION	2008	128144.04	6647.11	51150.94	-44503.83	12801.29
1309	SANCHEZ CARRION	2009	136142.87	5036.54	42421.87	-37385.33	7295.63
1309	SANCHEZ CARRION	2010	120428.27	3882.76	47342.52	-43459.76	8800.79
1310	SANTIAGO DE CHUCO	2007	83824.12	3459.02	59767.81	-56308.79	12716.33
1310	SANTIAGO DE CHUCO	2008	100178.35	3896.61	67558.61	-63662	10727.78
1310	SANTIAGO DE CHUCO	2009	92988.47	7492.65	51109.5	-43616.85	8103
1310	SANTIAGO DE CHUCO	2010	94258.93	4672.51	38115.37	-33442.86	3817.32
1311	GRAN CHIMU	2007	27740.26	4555.02	12493.61	-7938.59	3630.93
1311	GRAN CHIMU	2008	21685.09	4124.23	25087.72	-20963.49	1305.12
1311	GRAN CHIMU	2009	18810.69	794.94	22463.68	-21668.74	.
1311	GRAN CHIMU	2010	24547.60	5820.59	19053.67	-13233.08	833.84
1312	VIRU	2007	18389.47	11154.09	8172.35	2981.74	.
1312	VIRU	2008	17511.11	10010.75	12672.92	-2662.17	.
1312	VIRU	2009	19518.54	10681.11	12824.04	-2142.93	.
1312	VIRU	2010	20912.29	8836.59	19512.44	-10675.85	.
1401	CHICLAYO	2007	812198.76	285115	205296.4	79818.6	130150.2
1401	CHICLAYO	2008	864682.53	276457.1	225515.2	50941.9	122692.8
1401	CHICLAYO	2009	870952.28	283603.4	211493.7	72109.7	149838.9
1401	CHICLAYO	2010	914940.64	272284.3	224709.9	47574.4	144005.6
1402	FERREÑAFE	2007	74628.02	9212.06	27551.3	-18339.24	2378.43
1402	FERREÑAFE	2008	77130.84	12231.79	38371.62	-26139.83	3104.69
1402	FERREÑAFE	2009	71972.34	9964.12	39226.14	-29262.02	2857.99
1402	FERREÑAFE	2010	75034.74	11709.94	38702.99	-26993.05	2303.24

1403	LAMBAYEQUE	2007	324489.07	59513.4	94386.37	-34872.97	15905.41
1403	LAMBAYEQUE	2008	337005.22	53716.76	95435.39	-41718.63	23087.21
1403	LAMBAYEQUE	2009	353118.92	56048.62	102827.9	-46779.28	22501.86
1403	LAMBAYEQUE	2010	330064.99	60776.51	99314.64	-38538.13	19624.06
1501	LIMA	2007	7974606.00	3324187	588661.7	2735525.3	3378358
1501	LIMA	2008	8329135.00	3399772	620199.3	2779572.7	3394944
1501	LIMA	2009	8540445.00	3486914	605004	2881910	3451254
1501	LIMA	2010	8747908.00	3446291	625289.6	2821001.4	3645453
1502	BARRANCA	2007	146799.83	48870.79	48046.99	823.8	21644.84
1502	BARRANCA	2008	136984.29	48533.7	46538.34	1995.36	12311.23
1502	BARRANCA	2009	148752.69	45106.55	45581.56	-475.01	20726.06
1502	BARRANCA	2010	159726.20	54545.07	43095.63	11449.44	15822.08
1503	CAJATAMBO	2007	7458.24	.	13769.21	.	.
1503	CAJATAMBO	2008	4928.42	.	24508.35	.	.
1503	CAJATAMBO	2009	5629.89	.	22911.46	.	.
1503	CAJATAMBO	2010	5651.36	.	17520.93	.	.
1504	CANTA	2007	8709.28	2702.88	15492.43	-12789.55	600.64
1504	CANTA	2008	8384.58	1863.24	13065.53	-11202.29	310.54
1504	CANTA	2009	7621.97	1988.34	17179.06	-15190.72	331.39
1504	CANTA	2010	7366.48	2009.04	17522.75	-15513.71	.
1505	CAÑETE	2007	157525.98	52483.77	72474.88	-19991.11	36796.41
1505	CAÑETE	2008	155080.58	47287.66	56239.13	-8951.47	34049.32
1505	CAÑETE	2009	165799.55	50537.89	80616.77	-30078.88	43903.92
1505	CAÑETE	2010	150466.22	44949.64	44701.71	247.93	33695.27
1506	HUARAL	2007	189225.21	79531.91	42065.59	37466.32	22243.95
1506	HUARAL	2008	196187.97	82384.12	61441.78	20942.34	17232.62
1506	HUARAL	2009	196289.84	70492.57	63814.58	6677.99	17444.96
1506	HUARAL	2010	203345.47	78877.17	57292.68	21584.49	30379.09
1507	HUAROCHIRI	2007	56645.26	17404.3	57994.94	-40590.64	4066.15
1507	HUAROCHIRI	2008	57920.28	19647.33	74110.19	-54462.86	840.49
1507	HUAROCHIRI	2009	52487.85	19153.33	46380.94	-27227.61	3311.16
1507	HUAROCHIRI	2010	56216.17	20804.75	56140.78	-35336.03	2268.42
1508	HUAURA	2007	254401.17	90277.96	79611.25	10666.71	61622.13
1508	HUAURA	2008	295603.04	79885.14	82106.53	-2221.39	81192.2
1508	HUAURA	2009	283148.33	78395.23	87570.11	-9174.88	81427.75
1508	HUAURA	2010	311011.49	98569.3	73853.32	24715.98	79181.43
1509	OYON	2007	38696.35	10420.84	45443.23	-35022.39	.
1509	OYON	2008	40225.02	11802.32	27444.02	-15641.7	.
1509	OYON	2009	44581.55	9031.51	28292.26	-19260.75	193.86
1509	OYON	2010	46612.93	13450.44	25823.55	-12373.11	.
1510	YAUYOS	2007	24817.82	2715.02	41768.73	-39053.71	910.59
1510	YAUYOS	2008	30094.74	2246.26	37780.66	-35534.4	1587.68
1510	YAUYOS	2009	29893.34	3767.14	38870.56	-35103.42	1889.97
1510	YAUYOS	2010	34279.05	3624.66	46990.31	-43365.65	669.68
1601	MAYNAS	2007	522870.56	107974.7	140843.9	-32869.2	188318.3
1601	MAYNAS	2008	552275.54	100209.9	136103.2	-35893.3	166846.2
1601	MAYNAS	2009	561906.38	100781.1	146506.3	-45725.2	197897.3
1601	MAYNAS	2010	589447.62	113490.2	134491.6	-21001.4	222718.9
1602	ALTO AMAZONAS	2007	132036.12	25997.21	59566.63	-33569.42	17366.13
1602	ALTO AMAZONAS	2008	133217.45	23720.11	53113.11	-29393	20845.11
1602	ALTO AMAZONAS	2009	138247.64	30691.48	54083.05	-23391.57	16230.19
1602	ALTO AMAZONAS	2010	126929.13	25153.32	46488.75	-21335.43	17302.41
1603	LORETO	2007	69655.74	13627.03	26319.38	-12692.35	4979.93
1603	LORETO	2008	88447.08	16883.46	22794.37	-5910.91	3492.9
1603	LORETO	2009	79740.66	17715.45	24228.06	-6512.61	1358.64
1603	LORETO	2010	78896.97	17816.67	25736.96	-7920.29	2283.81
1604	MARISCAL RAMON CASTILLA	2007	72438.96	13611.74	13433.61	178.13	6455.86

1604	MARISCAL RAMON CASTILLA	2008	67722.56	17749.41	9934.83	7814.58	5483.75
1604	MARISCAL RAMON CASTILLA	2009	74992.02	18521.75	10814.4	7707.35	5106.41
1604	MARISCAL RAMON CASTILLA	2010	65441.79	13689.88	19465.79	-5775.91	4026.7
1605	REQUENA	2007	85469.47	16439.36	35565.92	-19126.56	10613.57
1605	REQUENA	2008	101228.41	20745.27	34036.3	-13291.03	11612.61
1605	REQUENA	2009	104058.61	13502.68	31362.25	-17859.57	12029.28
1605	REQUENA	2010	113267.16	13894.37	32614.63	-18720.26	9997.07
1606	UCAYALI	2007	53885.96	12181.95	44244.22	-32062.27	4406.93
1606	UCAYALI	2008	59078.43	10884.71	37202.04	-26317.33	3485.79
1606	UCAYALI	2009	55267.04	10837.08	34755.82	-23918.74	3110.95
1606	UCAYALI	2010	58312.36	8016.19	44299.07	-36282.88	4714.15
1607	DATEM DEL MARAÑON	2007	57231.36	3766.9	3467.94	298.96	1066.7
1607	DATEM DEL MARAÑON	2008	61841.22	2953.68	2550.56	403.12	2328.28
1607	DATEM DEL MARAÑON	2009	58045.13	3588.69	3362.2	226.49	1912.32
1607	DATEM DEL MARAÑON	2010	64824.55	2435.14	3963.63	-1528.49	4457.36
1608	PUTUMAYO	2007	.	.	.	.	.
1608	PUTUMAYO	2008	.	.	.	.	.
1608	PUTUMAYO	2009	.	.	.	.	.
1608	PUTUMAYO	2010	.	.	.	.	.
1701	TAMBOPATA	2007	84690.65	36162.97	13953.6	22209.37	3328.63
1701	TAMBOPATA	2008	91809.45	38120.22	18663.23	19456.99	4522.66
1701	TAMBOPATA	2009	99994.24	40596.42	11922.69	28673.73	4018.64
1701	TAMBOPATA	2010	106935.65	40239.41	14531.5	25707.91	5237.75
1702	MANU	2007	16311.30	11681.95	2573.27	9108.68	308.47
1702	MANU	2008	17441.09	11272.26	2096.53	9175.73	395.55
1702	MANU	2009	19805.13	11863.83	2472.07	9391.76	431.91
1702	MANU	2010	21171.62	14499.18	6969.11	7530.07	201.24
1703	TAHUAMANU	2007	9561.90	3422.2	3480.55	-58.35	505.96
1703	TAHUAMANU	2008	10334.15	4028.55	9977.32	-5948.77	470.05
1703	TAHUAMANU	2009	12584.47	4677.61	4462.5	215.11	571.41
1703	TAHUAMANU	2010	12286.53	4395.3	2627.47	1767.83	800.9
1801	MARISCAL NIETO	2007	77587.50	22018.02	26659.91	-4641.89	10388.55
1801	MARISCAL NIETO	2008	78333.44	25407.75	20236.79	5170.96	12597.08
1801	MARISCAL NIETO	2009	83923.13	30111.96	21464.72	8647.24	15827.05
1801	MARISCAL NIETO	2010	88129.27	30349.75	16356.05	13993.7	15725.61
1802	GENERAL SANCHEZ CERRO	2007	29141.96	4360.1	19118.96	-14758.86	842.57
1802	GENERAL SANCHEZ CERRO	2008	26635.61	5237.63	18532.81	-13295.18	646.72
1802	GENERAL SANCHEZ CERRO	2009	28916.33	5301.95	19372.82	-14070.87	1554.79
1802	GENERAL SANCHEZ CERRO	2010	27185.43	4329.32	18332.17	-14002.85	1612.97
1803	ILO	2007	66968.19	33716.25	11207.94	22508.31	1844.07
1803	ILO	2008	68395.28	35436.2	13346.05	22090.15	1790.02
1803	ILO	2009	68609.80	33810.13	7686.37	26123.76	2761.56
1803	ILO	2010	68206.33	36889.84	12011.24	24878.6	1950.01
1901	PASCO	2007	158270.41	32972.96	116820.6	-83847.64	27604.26
1901	PASCO	2008	165194.63	38152.6	118188.4	-80035.8	29453.64
1901	PASCO	2009	172831.79	37943.54	145473.6	-107530.06	34539.72
1901	PASCO	2010	174746.86	36465.36	101829.5	-65364.14	35973.51

1902	DANIEL ALCIDES CARRION	2007	51918.14	7122.92	30936.04	-23813.12	3159.06
1902	DANIEL ALCIDES CARRION	2008	52366.36	9508.48	42576.06	-33067.58	4071.82
1902	DANIEL ALCIDES CARRION	2009	52468.35	9080.66	46505.93	-37425.27	2195.17
1902	DANIEL ALCIDES CARRION	2010	52526.12	8634.97	36689.23	-28054.26	2013.21
1903	OXAPAMPA	2007	83423.20	26102.18	26528.56	-426.38	4978.11
1903	OXAPAMPA	2008	84354.43	19970.27	25527.17	-5556.9	5791.67
1903	OXAPAMPA	2009	90571.59	22024.56	36650.45	-14625.89	7533.13
1903	OXAPAMPA	2010	90622.45	24610.85	28732.32	-4121.47	8030.23
2001	PIURA	2007	778226.27	191399.1	179707.9	11691.2	122871
2001	PIURA	2008	828620.26	196819.3	167485.5	29333.8	112139.6
2001	PIURA	2009	850381.21	183887.1	149804.7	34082.4	104391.6
2001	PIURA	2010	909070.28	179794.9	155626.2	24168.7	116178.1
2002	AYABACA	2007	123503.67	5205.78	86736.72	-81530.94	1452.85
2002	AYABACA	2008	118359.56	4680.28	109084.8	-104404.52	973.47
2002	AYABACA	2009	140570.72	1758.09	98564.92	-96806.83	2070.04
2002	AYABACA	2010	128594.36	3748.5	103652.4	-99903.9	2109.7
2003	HUANCABAMBA	2007	145247.02	8683.37	83229.64	-74546.27	7562.73
2003	HUANCABAMBA	2008	157911.20	12991.52	86478.86	-73487.34	3990.83
2003	HUANCABAMBA	2009	143929.48	13944.18	92314.21	-78370.03	8080.83
2003	HUANCABAMBA	2010	149852.24	10168.41	97884.56	-87716.15	9563.22
2004	MORROPON	2007	283387.57	53389.26	111127.8	-57738.54	15794.73
2004	MORROPON	2008	294819.89	54221	104777.5	-50556.5	17157.75
2004	MORROPON	2009	310420.34	65518.92	130077	-64558.08	21556.35
2004	MORROPON	2010	306568.16	73567.09	101407.4	-27840.31	19016.67
2005	PAITA	2007	118655.63	25421.8	25511.91	-90.11	10116.53
2005	PAITA	2008	102715.60	36464.78	23390.12	13074.66	7226.58
2005	PAITA	2009	110546.74	22897.91	25551.74	-2653.83	1578.93
2005	PAITA	2010	123336.33	30623.59	27037.64	3585.95	1390.96
2006	SULLANA	2007	210684.24	42976.95	112062.7	-69085.75	31207.85
2006	SULLANA	2008	226602.93	41274.61	127775.6	-86500.99	27591.05
2006	SULLANA	2009	246180.88	40528.52	123344	-82815.48	21717.44
2006	SULLANA	2010	232500.70	43241.17	97537.05	-54295.88	14497.13
2007	TALARA	2007	126899.85	30056.14	82255.42	-52199.28	15093.98
2007	TALARA	2008	112421.92	20206.61	71220.07	-51013.46	11876.43
2007	TALARA	2009	134446.00	28492.94	75818.63	-47325.69	14234.1
2007	TALARA	2010	126709.53	29225.15	70526.35	-41301.2	15984.6
2008	SECHURA	2007	14967.01	3480.7	12925.85	-9445.15	348.07
2008	SECHURA	2008	11315.20	5990.4	7218.64	-1228.24	332.8
2008	SECHURA	2009	11701.55	4680.62	8928.01	-4247.39	.
2008	SECHURA	2010	11831.40	4732.56	16726.85	-11994.29	.
2101	PUNO	2007	259072.02	36163.1	106493.9	-70330.8	26944.5
2101	PUNO	2008	250490.37	36409.6	106065.3	-69655.7	14743.43
2101	PUNO	2009	263287.32	35120.35	133290	-98169.65	24940.13
2101	PUNO	2010	241756.59	32790.48	139190.7	-106400.22	26193.89
2102	AZANGARO	2007	153551.07	11719.08	92764.82	-81045.74	5434.54
2102	AZANGARO	2008	159790.46	11755.05	92644.34	-80889.29	5810.11
2102	AZANGARO	2009	181915.45	13246.31	101602.7	-88356.39	7959.8
2102	AZANGARO	2010	166926.23	13928.84	111315.8	-97386.96	12771.99
2103	CARABAYA	2007	101535.08	12680.53	9123.28	3557.25	1153.4
2103	CARABAYA	2008	95323.33	13629.37	17514.24	-3884.87	2278.21
2103	CARABAYA	2009	99751.26	19012.37	9096.77	9915.6	2728.81
2103	CARABAYA	2010	100460.62	7672.29	10948.48	-3276.19	1366.99
2104	CHUCUITO	2007	69590.80	4517.55	51537.5	-47019.95	742.82
2104	CHUCUITO	2008	74998.53	5682.17	57878.64	-52196.47	380.84

2104	CHUCUITO	2009	60490.58	4072.9	45883.39	-41810.49	1186.94
2104	CHUCUITO	2010	59086.60	4181.59	48231.45	-44049.86	756.18
2105	EL COLLAO	2007	108457.19	13005.73	40759.55	-27753.82	10312.75
2105	EL COLLAO	2008	115844.37	9814.53	39566.93	-29752.4	8788.41
2105	EL COLLAO	2009	109682.12	12097.86	36471.63	-24373.77	2015.35
2105	EL COLLAO	2010	109334.07	15096.38	36927.3	-21830.92	6738.78
2106	HUANCANE	2007	100741.27	6854.54	68178.94	-61324.4	2998.72
2106	HUANCANE	2008	97520.92	10908.32	67958.21	-57049.89	3102.73
2106	HUANCANE	2009	97092.79	10432.37	66343.12	-55910.75	1212.89
2106	HUANCANE	2010	116343.79	9672.49	65076.11	-55403.62	3481.81
2107	LAMPA	2007	42624.61	6321.2	34665.74	-28344.54	1103.25
2107	LAMPA	2008	44007.78	4936.31	26820.13	-21883.82	2647.54
2107	LAMPA	2009	46338.59	792.96	28865.09	-28072.13	396.48
2107	LAMPA	2010	45659.08	3467.85	19512.87	-16045.02	2725.03
2108	MELGAR	2007	101328.09	18241.13	48786.39	-30545.26	5956.5
2108	MELGAR	2008	115602.67	18544.22	31193.34	-12649.12	7503.26
2108	MELGAR	2009	136946.73	19765.4	38087.52	-18322.12	8950.68
2108	MELGAR	2010	142242.99	23043.19	38298.41	-15255.22	10301.75
2109	MOHO	2007	49507.03	1141.01	29642.33	-28501.32	763.28
2109	MOHO	2008	56160.30	2260.18	30519.39	-28259.21	362.18
2109	MOHO	2009	66754.14	4989.92	28839.12	-23849.2	440.54
2109	MOHO	2010	59099.67	418.67	28545.69	-28127.02	380.35
2110	SAN ANTONIO DE PUTINA	2007	43293.98	33669.64	12980.78	20688.86	2146.4
2110	SAN ANTONIO DE PUTINA	2008	44612.41	34072.72	13697.29	20375.43	1099.61
2110	SAN ANTONIO DE PUTINA	2009	45726.35	22071.2	12719.93	9351.27	10257.4
2110	SAN ANTONIO DE PUTINA	2010	64279.99	40499.76	9515.74	30984.02	8992.36
2111	SAN ROMAN	2007	256472.04	127546.9	47852.22	79694.68	7744.46
2111	SAN ROMAN	2008	296398.90	128970.8	64620.35	64350.45	10463.53
2111	SAN ROMAN	2009	278350.86	126402.7	52230.8	74171.9	11300.29
2111	SAN ROMAN	2010	290628.37	120955.8	70470.84	50484.96	5488.46
2112	SANDIA	2007	76018.44	9852.15	18452.41	-8600.26	4729.37
2112	SANDIA	2008	69510.26	8824.96	22839.26	-14014.3	11787.82
2112	SANDIA	2009	69386.12	8588.5	19510.94	-10922.44	10674.26
2112	SANDIA	2010	78353.83	10192.36	20011.51	-9819.15	8979.48
2113	YUNGUYO	2007	45263.42	2593.5	25274.77	-22681.27	1128.5
2113	YUNGUYO	2008	42816.17	791.93	26313.58	-25521.65	1960.46
2113	YUNGUYO	2009	43449.74	784.02	18189.97	-17405.95	1176.03
2113	YUNGUYO	2010	45102.77	418.67	20322.18	-19903.51	1636.36
2201	MOYOBAMBA	2007	128501.94	61501.87	34067.07	27434.8	4438.85
2201	MOYOBAMBA	2008	133964.59	72574.7	35123.92	37450.78	4365.88
2201	MOYOBAMBA	2009	129345.45	67636.11	43561.52	24074.59	5093.43
2201	MOYOBAMBA	2010	140290.35	62233.81	36821.39	25412.42	7750.07
2202	BELLAVISTA	2007	66304.11	31161.52	15227.7	15933.82	5259.77
2202	BELLAVISTA	2008	60429.24	23561.19	17076.78	6484.41	2794.24
2202	BELLAVISTA	2009	71028.56	22260.34	18215.91	4044.43	5462.78
2202	BELLAVISTA	2010	70571.70	24498.52	11378.38	13120.14	5739.01
2203	EL DORADO	2007	25121.51	6991.59	30354.48	-23362.89	938.64
2203	EL DORADO	2008	23464.81	7324.72	25219.52	-17894.8	770.02
2203	EL DORADO	2009	25937.57	6691.64	24251.49	-17559.85	621.05
2203	EL DORADO	2010	22172.13	4953.79	33394.42	-28440.63	744
2204	HUALLAGA	2007	18673.89	6804.3	17238.12	-10433.82	2960.58
2204	HUALLAGA	2008	19467.93	7799.14	20974.57	-13175.43	2040.94
2204	HUALLAGA	2009	22824.30	9185.55	17178.27	-7992.72	4463.73
2204	HUALLAGA	2010	21755.62	10048.57	11306.75	-1258.18	970.77

2205	LAMAS	2007	87689.00	22788.84	41339.67	-18550.83	4412.36
2205	LAMAS	2008	93840.49	23994.34	46306.6	-22312.26	5935.35
2205	LAMAS	2009	103338.85	27593.73	45664.85	-18071.12	3748.18
2205	LAMAS	2010	93455.26	23670.18	40482.02	-16811.84	5773.28
2206	MARISCAL CACERES	2007	55068.97	23543.53	25031.9	-1488.37	5501.27
2206	MARISCAL CACERES	2008	65978.61	25343.8	24712.96	630.84	5000.23
2206	MARISCAL CACERES	2009	66032.07	21914.45	20146.43	1768.02	8177.18
2206	MARISCAL CACERES	2010	72044.34	22472.26	22411.02	61.24	8952.88
2207	PICOTA	2007	57149.19	21932.12	19879.88	2052.24	4359.95
2207	PICOTA	2008	58628.78	19740.04	19015.78	724.26	5871.22
2207	PICOTA	2009	70838.10	34064.37	21019.36	13045.01	2565.72
2207	PICOTA	2010	72116.37	23205.82	19684.92	3520.9	5527.69
2208	RIOJA	2007	111819.50	54299.34	30197.48	24101.86	6843.11
2208	RIOJA	2008	131776.48	68790.13	29950.54	38839.59	7555.02
2208	RIOJA	2009	127119.27	63402.79	21310.08	42092.71	8715.61
2208	RIOJA	2010	117857.42	58394.57	19434.62	38959.95	11555.05
2209	SAN MARTIN	2007	166137.07	73438.99	63009.04	10429.95	29612.79
2209	SAN MARTIN	2008	173221.13	67486.82	64049.43	3437.39	31136.82
2209	SAN MARTIN	2009	169387.94	69631.58	74283.26	-4651.68	36179.77
2209	SAN MARTIN	2010	179270.62	75703.82	57051.31	18652.51	32600.24
2210	TOCACHE	2007	71932.47	35685.01	26741.92	8943.09	4139.48
2210	TOCACHE	2008	78076.33	33970.03	21876.5	12093.53	5943.19
2210	TOCACHE	2009	77709.73	35071.32	24655.12	10416.2	7725.43
2210	TOCACHE	2010	72923.05	37556.55	32892.63	4663.92	4801.98
2301	TACNA	2007	289235.24	145564.1	24186.83	121377.27	70517.54
2301	TACNA	2008	301616.79	139089.6	16160.02	122929.58	83145.01
2301	TACNA	2009	309146.70	134546.9	24119.02	110427.88	79676.93
2301	TACNA	2010	316929.13	142036.8	25507.94	116528.86	91084.82
2302	CANDARAVE	2007	9343.32	1697.44	6975.94	-5278.5	310.82
2302	CANDARAVE	2008	10580.49	2826.95	8309.48	-5482.53	227.72
2302	CANDARAVE	2009	10072.03	3993.3	7654.3	-3661	279.27
2302	CANDARAVE	2010	9218.38	4488.18	9981.76	-5493.58	343.86
2303	JORGE BASADRE	2007	5962.11	4637.18	8703.18	-4066	230.07
2303	JORGE BASADRE	2008	6308.90	4425.86	9846.51	-5420.65	355.49
2303	JORGE BASADRE	2009	6838.30	4320.96	10645	-6324.04	320.7
2303	JORGE BASADRE	2010	7284.06	4900.27	9320.49	-4420.22	51.84
2304	TARATA	2007	8396.12	2000.21	6955.38	-4955.17	486.23
2304	TARATA	2008	7212.72	1740.28	9033.78	-7293.5	530.32
2304	TARATA	2009	9668.16	1845.34	9455.49	-7610.15	608.79
2304	TARATA	2010	7940.12	2593.28	9952	-7358.72	683.64
2401	TUMBES	2007	154579.49	43093.35	37390.22	5703.13	9188.16
2401	TUMBES	2008	160337.94	38438.53	34773.69	3664.84	14960.27
2401	TUMBES	2009	168284.75	38065.82	41730.56	-3664.74	22341.39
2401	TUMBES	2010	171444.27	34344.66	38495.01	-4150.35	23788.73
2402	CONTRALMIRANTE VILLAR	2007	19751.95	10850.44	4972.53	5877.91	1247.47
2402	CONTRALMIRANTE VILLAR	2008	26088.40	16803.4	7110.86	9692.54	1711.6
2402	CONTRALMIRANTE VILLAR	2009	19246.95	11706.2	9631.55	2074.65	1956.89
2402	CONTRALMIRANTE VILLAR	2010	22595.15	16743.41	13347.14	3396.27	1847.94
2403	ZARUMILLA	2007	39395.23	13703.33	3913.26	9790.07	1351.82
2403	ZARUMILLA	2008	41950.24	18444.49	2987.76	15456.73	2555.49
2403	ZARUMILLA	2009	44830.02	18524.78	3253.75	15271.03	2093.4
2403	ZARUMILLA	2010	42961.91	21678.88	5249.19	16429.69	1586.62
2501	CORONEL PORTILLO	2007	357271.45	126571.2	76129.99	50441.21	54845.19
2501	CORONEL PORTILLO	2008	391672.61	131019.8	88623.22	42396.58	49206.35

2501	CORONEL PORTILLO	2009	414277.26	133768.9	84998.77	48770.13	51283.43
2501	CORONEL PORTILLO	2010	425053.70	138780.6	64151.85	74628.75	56362.5
2502	ATALAYA	2007	44746.82	8913.41	8370.1	543.31	411.93
2502	ATALAYA	2008	50399.37	8438.38	7498.27	940.11	502.52
2502	ATALAYA	2009	48533.45	9841.45	9438.81	402.64	1116.51
2502	ATALAYA	2010	40788.90	9147.42	11294.94	-2147.52	619.95
2503	PADRE ABAD	2007	67602.55	41219.93	12864.72	28355.21	790.44
2503	PADRE ABAD	2008	62720.81	35000.32	12165.19	22835.13	780.9
2503	PADRE ABAD	2009	63098.82	33878.69	12862.21	21016.48	1168.03
2503	PADRE ABAD	2010	62115.16	33729.14	10219.68	23509.46	336.3
2504	PURUS	2007	3324.62	2429.53	453.58	1975.95	.
2504	PURUS	2008	2688.20	1209.69	687.1	522.59	.
2504	PURUS	2009	3123.60	1691.95	740.75	951.2	.
2504	PURUS	2010	3173.80	1586.9	967.59	619.31	.

Annex 7: Instrumental Variable Regression (2SLS) – First Stage Estimations

	Sum of Monthly Precipitation / 1,000 (Squared) (Grid 1-2)	
	A7.1	**A7.2**
Year (2007=1)	-0.003 (0.010)	-0.003 (0.010)
Year (2008=1)	-0.008 (0.010)	-0.008 (0.010)
Year (2009=1)	-0.000 (0.010)	-0.000 (0.009)
Year (2010=1)	(Omitted)	(Omitted)
Poverty rate	-0.028 (0.049)	-0.028 (0.049)
Per capita income/100	0.001 (0.001)	0.001 (0.001)
Sum of monthly precipitation/1,000 (Grid 3-4)	0.789*** (0.036)	0.789*** (0.036)
Rural population rate	0.014 (0.129)	.
Province fixed effects	YES	YES
Number of observations	***758***	***768***
R-Squared	***0.955***	***0.955***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

Annex 8: The Effect of Positive and Negative Rainfall Shocks on Internal Migration Patterns (±0.9 Standard Deviations) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	A8.1	**A8.2**	**A8.3**	**A8.4**	**A8.5**
Year (2007=1)	-0.007 (0.024)	0.014** (0.006)	0.027 (0.028)	0.001 (0.004)	0.014*** (0.003)
Year (2008=1)	0.008 (0.019)	0.005 (0.004)	0.011 (0.025)	0.000 (0.003)	0.009*** (0.002)
Year (2009=1)	0.010 (0.017)	-0.002 (0.004)	-0.005 (0.018)	-0.000 (0.003)	0.005* (0.002)
Year (2010=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Poverty rate	-0.030 (0.126)	-0.016 (0.026)	-0.082 (0.172)	-0.023 (0.018)	0.002 (0.011)
Per capita income/100	-0.002 (0.002)	0.000 (0.000)	0.002 (0.002)	-0.000 (0.000)	-0.000 (0.000)
Rural population rate	-0.285 (0.210)	-0.077 (0.082)	0.229 (0.227)	-0.031 (0.053)	.
Positive rainfall shock (≥0.9) (Yes=1)	-0.005 (0.022)	0.009 (0.005)	0.002 (0.028)	0.000 (0.004)	0.004* (0.002)
Negative rainfall shock (≤-0.9) (Yes=1)	0.080 (0.066)	0.010 (0.017)	-0.061 (0.056)	-0.015 (0.019)	0.003 (0.006)
No rainfall shock (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Sum of monthly precipitation/1,000	0.085 (0.137)	0.043 (0.027)	-0.020 (0.168)	-0.003 (0.022)	0.000 (0.012)
Sum of monthly precipitation/1,000 (Squared)	-0.010 (0.058)	-0.025* (0.013)	-0.022 (0.063)	0.004 (0.013)	-0.004 (0.007)
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***758***	***758***	***768***	***729***	***768***
R-Squared	***0.927***	***0.956***	***0.892***	***0.929***	***0.997***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

Annex 9: Summary Statistics of Natural Disasters – Full Sample

	Full Sample				
	Mean	***S.D.***	***Min***	***Max***	***N***
Number of Floods (Continuous)	0.926	2.139	0	20	780
Floods (Dummy)	0.346	0.476	0	1	780
Number of Landslides (Continuous)	0.523	1.211	0	13	780
Landslides (Dummy)	0.283	0.451	0	1	784
Hectares of Agricultural Area Affected (Continuous)	200.228	1032.178	0	12074	780
Agricultural Area Affected (Dummy)	0.217	0.412	0	1	784

Annex 10: Summary Statistics of Natural Disasters by Geographic Region

	Coast			Highlands			Amazon		
	Mean	***S.D.***	***N***	***Mean***	***S.D.***	***N***	***Mean***	***S.D.***	***N***
Number of Floods (Continuous)	0.341	0.861	164	0.622	1.46	468	2.534	3.658	148
Floods (Dummy)	0.207	0.407	164	0.288	0.453	468	0.671	0.471	152
Number of Landslides (Continuous)	0.213	0.707	164	0.523	1.064	468	0.858	1.844	148
Landslides (Dummy)	0.134	0.342	164	0.310	0.463	468	0.362	0.482	152
Hectares of Agricultural Area Affected (Continuous)	103.518	513.403	164	252.282	1236.32	468	142.791	689.462	148
Agricultural Area Affected (Dummy)	0.140	0.348	164	0.248	0.432	468	0.204	0.404	152

Annex 11: The Effect of Natural Disasters on Internal Migration Patterns (Coast) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	**Immigration rate**	**Emigration rate**	**Intra-province migration rate**	**Rural population rate**
	A11.1	**A11.2**	**A11.3**	**A11.4**	**A11.5**
Sum of monthly precipitation/1,000	0.325 (0.372)	0.113 (0.166)	-0.211 (0.299)	-0.005 (0.097)	-0.108** (0.048)
Sum of monthly precipitation/1,000 (Squared)	-0.583* (0.331)	-0.109 (0.127)	0.474* (0.261)	0.002 (0.068)	0.069** (0.034)
Positive rainfall shock (≥0.75) (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Negative rainfall shock (≤-0.75) (Yes=1)	0.071 (0.054)	0.001 (0.020)	-0.070 (0.046)	-0.000 (0.016)	-0.002 (0.015)
No rainfall shock (Yes=1)	-0.043 (0.027)	0.001 (0.010)	0.044* (0.025)	0.002 (0.008)	-0.005 (0.003)
Floods (Continuous)	-0.002 (0.007)	-0.002 (0.003)	0.000 (0.007)	0.002 (0.002)	-0.001 (0.001)
Landslides (Continuous)	0.011 (0.008)	-0.005 (0.006)	-0.015* (0.008)	0.005 (0.003)	0.007** (0.003)
Agricultural area affected (Continuous)	-0.010 (0.011)	-0.001 (0.005)	0.009 (0.009)	0.005 (0.005)	0.001 (0.002)
Year fixed effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***163***	***163***	***163***	***156***	***163***
R-Squared	***0.906***	***0.928***	***0.917***	***0.951***	***0.998***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

Annex 12: The Effect of Natural Disasters on Internal Migration Patterns (Highlands) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	A12.1	**A12.2**	**A12.3**	**A12.4**	**A12.5**
Sum of monthly precipitation/1,000	-0.199 (0.275)	-0.013 (0.046)	0.267 (0.300)	0.008 (0.041)	-0.006 (0.020)
Sum of monthly precipitation/1,000 (Squared)	0.322 (0.250)	0.030 (0.048)	-0.333 (0.242)	-0.004 (0.034)	0.003 (0.015)
Positive rainfall shock (≥0.75) (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Negative rainfall shock (≤-0.75) (Yes=1)	-0.011 (0.061)	0.032 (0.027)	0.075 (0.085)	0.011 (0.009)	0.002 (0.007)
No rainfall shock (Yes=1)	0.035 (0.041)	-0.010 (0.007)	-0.018 (0.055)	0.003 (0.006)	-0.003 (0.003)
Floods (Continuous)	-0.003 (0.004)	0.000 (0.001)	0.004 (0.004)	0.001 (0.001)	-0.001 (0.001)
Landslides (Continuous)	0.001 (0.006)	-0.001 (0.002)	-0.000 (0.007)	-0.001 (0.001)	0.000 (0.001)
Agricultural area affected (Continuous)	-0.003 (0.002)	0.000 (0.001)	0.002 (0.003)	0.002** (0.001)	0.000 (0.002)
Year fixed effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***449***	***449***	***459***	***429***	***459***
R-Squared	***0.899***	***0.923***	***0.872***	***0.893***	***0.995***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

Annex 13: The Effect of Natural Disasters on Internal Migration Patterns (Amazon) – Pooled Ordinary Least Squares Estimations

	Migration balance rate	Immigration rate	Emigration rate	Intra-province migration rate	Rural population rate
	A13.1	**A13.2**	**A13.3**	**A13.4**	**A13.5**
Sum of monthly precipitation/1,000	-0.045 (0.252)	0.013 (0.075)	0.059 (0.218)	0.016 (0.072)	0.064 (0.041)
Sum of monthly precipitation/1,000 (Squared)	0.018 (0.083)	-0.017 (0.029)	-0.035 (0.070)	0.004 (0.030)	-0.025 (0.016)
Positive rainfall shock (≥0.75) (Yes=1)	0.029 (0.029)	0.013 (0.012)	-0.017 (0.027)	-0.012* (0.007)	-0.001 (0.008)
No rainfall shock (Yes=1)	(Omitted)	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Floods (Continuous)	0.003 (0.002)	0.000 (0.001)	-0.002 (0.002)	0.001 (0.001)	-0.001 (0.001)
Landslides (Continuous)	-0.003 (0.003)	0.000 (0.001)	0.003 (0.003)	0.000 (0.002)	0.000 (0.001)
Agricultural area affected (Continuous)	-0.010 (0.006)	0.001 (0.004)	0.011* (0.006)	-0.004* (0.003)	-0.002 (0.002)
Year fixed effects	YES	YES	YES	YES	YES
Controls	YES	YES	YES	YES	YES
Province fixed effects	YES	YES	YES	YES	YES
Number of observations	***146***	***146***	***146***	***144***	***146***
R-Squared	***0.910***	***0.966***	***0.887***	***0.918***	***0.995***

Robust standard errors are in parenthesis

****p<0.01, **p<0.05, *p<0.1*

Note: Rural population rate is statistically significant in equation A13.2, and its estimated parameter is 0.294. But it is not significant in equation A13.3.