Effects of Sudden Disasters on International Labour Migration from Disaster Prone Developing Country- The Case from Nepal*

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Abstract

As sudden disasters can influence various forms of human migration, they might also have influences on the international labour migration pattern. Lack of knowledge on whether it affects adversely or positively might have attracted a decision dilemma to the disaster-prone, labour exporting, developing countries more often while formulating appropriate labour market policies before and after a sudden disaster. This paper exploits the case of 7.5 magnitudes, April 2015 Earthquake of Nepal to examine the causal impacts on international labour outflow by employing various difference-in-difference frameworks with fixed-effects, interactive fixed-effects and spatial variation. This paper considers the National Reconstruction Authority's definition of severely affected districts as treatment groups and other least affected districts as the comparison group. This research finds the evidence of an overall reduction in the outflow of the international labour migration among highly affected districts in comparison to other remaining districts after the 2015 Nepal's earthquake among men. In contrast to these, the relationship between the earthquake and the outflow of female labour migrants was statistically insignificant. This paper increases the understanding of numerous multi-causal factors in post-disaster international labour migration changes and indicates that unique labour market intervention techniques might be necessary among male and female prospective international labour migrants.

Keywords: Disaster-Induced Migration, Gender, Nepal Earthquake 2015 **JEL Classification: J44, I18, H75**

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1 Introduction

Environmental migration in the form of internal household displacement, international migration, and internal labour migration, and also the return migration has been widely studied (Black et al. 2011, Landry et al. 2007, Koubi et al. 2016, Queiroz et al. 2019, Mallick & Siddiqui 2015, Paul 2005, Paul & Routray 2010, Raleigh et al. 2008, Sagynbekova 2017, Castles & Miller 2009, Parnell & Walawege 2011, Neumann & Hilderink 2015) but few focused on the international labour migration (de Moor 2011, Thornton 2011, de Moor 2011b, Henry et al. 2004). Among these, international labour migration has been commonly prescribed by most scholars as a post-disaster adaptation strategy to cover the disaster-induced loss on the income and employment opportunities (de Moor 2011, Thornton 2011, de Moor 2011b). However, a fundamental question has not been particularly addressed by the literature; "how does a sudden disaster affect the international labour out-migration trend?", and "how this impact varies across male and female?". As a result, there is a lack of clarity, when it comes to deciding an appropriate, demand-driven or citizen-centric labour market policy solutions, before and aftermath of a sudden disaster. Such a decision dilemma could be more frequently evident in developing countries, which are heavily reliant on remittance income and are prone to disasters.

This research uses the case of Nepal; a disaster prone[1] labour exporting[2], developing country in South Asia to examine the causal impacts of a sudden disaster on the country's overall existing international labour out-migration pattern. It further explores whether this impact varies across male and female. Mainly, it exploits the 7.3 magnitudes April 2015 earthquakes of Nepal as an exogenous event[3]NPC (2015), and tests its causal impacts with the time-series data on the labour permits issued by the government of Nepal's Department of Foreign Employment to its citizens for international labour migration from Nepal[4]. From the empirical analysis, this paper presents causal evidence of a sudden environmental event, adversely affecting the male labour out-migration trend. However, it finds that the effect of sudden disaster was statistically

[1]Nepal ranks 11th among the world's most earthquake-prone countries, fourth in terms of vulnerability of climate change and thirtieth on flood risks (UNDP 2009, IoM 2018, NEMRC 2020).

[2]As of 2019 remittance contributed to over a quarter of Nepal's GDP accounting at $8.79 billion(MoLESS 2020).

[3]This was considered a tremendous shock in over 80 years in the country's history, it affected around one-third of the country's population in diverse ways. The overall loss was equivalent to $7 billion- equivalent to one-third of Nepal's GDP in the fiscal year 2013/2014 (NPC 2015).

[4]As Nepal shares open borders to India, there is no requirements of the visa and work permits for the citizens of both the countries. Hence this data doesn't cover the labour migration to India (DOFE 2014).

insignificant on the outflow of female international labour migrants.

Likewise, this paper presents additional evidence to the Henry et al. (2004), but uses causal models on an updated observational time-series data from a disaster-prone, labour exporting, developing country. Firstly, this paper disentangles the multi-disciplinary influence on the environmental migration debate and flags attention towards the knowledge gap on the disaster-induced international labour migration. Whereas, the findings may close such an important literature gap and call attention for the further exploration of the topic. Secondly, this paper presents a causal framework to compare the outcomes between the treatment group (14 districts among 75 districts were considered as severely affected districts by the National Reconstruction Authority NRA (2020))[5], and comparison group (rest of the 61 districts). Unlike in the previous researches, this paper captures the various unobserved heterogeneity and addresses the problem with data crunch using an interactive fixed-effect model. Furthermore, this paper also provides a falsification argument by possibly eliminating the selection bias induced from including the districts that are far away from the epicentre as a comparison, and also from having districts like Kathmandu, Bhaktapur, and Lalitpur[6] Finally, this paper contributes to a great extent to the disaster-prone, labour sending developing countries in the decision making level; particularly in the labour market policy formulation before and after a sudden disaster.

This paper analyses array of literature on the environmental migration from the economic angle, political, demographic, security to psychological perspectives. After that, it compares and contrasts them to Nepal's case, and assumes "sudden natural disasters may influence adversely in the context of disaster-prone, labour exporting developing countries." It also recognises and extensively discusses the important institutional background[7], which could have multiple effects on the assumed relationship. Such unobserved heterogeneity includes various factors such as the trouble in Malaysia; Malaysia was the highest labour recipient country from Nepal at 42.14

[5]Severely affected districts: Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur (NRA 2020).

[6]These districts are the capital cities, are densely populated and also less reliant on the international labour migration(DOFE 2017).

[7]These unobserved heterogeneities are discussed later in this paper in a separate section. To summarise, Nepal faced dispute between the recruitment agencies and the government of Nepal regarding the new "free visa free ticket Policy" picked at around the same time frame. Similarly, Nepal's significant political changes such as the promulgation of the new constitution and historic first-ever general election of the federal democratic republic Nepal took place within the two years of the earthquake. Also, there were additional factors such as India's unofficial economic blocked with attracted unrest in the Terai region, weak oil price and currencies in the middle east, trouble in Malaysia; the highest migrant-receiving country from Nepal, and Nepal witnessing robust GDP growth.

percentage shares in total labour permits issued in 2014, but the outflow to Malaysia dropped significantly at around the same period to 14.62 percentage in 2016.

To test the relationship while capturing such unobserved heterogeneity, omitted variable bias, and to control nationwide time trends, this paper uses varieties of difference-in-difference analysis frameworks; difference-in-difference method (DID), difference-in-difference model with district and year fixed effects (FE DID), and difference-in-difference model with the interactive fixed-effect model (IFE). Finally, it uses those techniques to examine the relationship between 2015 earthquake on three different variables in three separate models; Nepal's total out-migration, male migration, and female migration respectively.

After this, the paper further conducts falsification test where it redefines the treatment districts; as the districts such as Kathmandu, Bhaktapur, and Lalitpur are less reliant on international labour migration, it excludes them this time. Additionally, as the tremors of the earthquake know no district boundaries, this time it only considers contiguous districts as the comparison districts.

Falsification test provided additional validity to the main results. It suggested that there was an overall reduction on the outflow of the international labour migration among highly affected districts in comparison to other remaining districts after the 2015 Nepal's earthquake. In contrast to these, the relationship between the earthquake and the outflow of female labour migrants was statistically insignificant. This means that the hypothesis was true only in the case of male foreign labour migrants, whereas female labour out-migration from the country was unaffected from the shock. This could be because the evidence suggests that the earthquake created economic disruptions. Still, the nature of employment generated in the home country in reconstruction was physically intensive and thus more attractive to men is compared to women(Sijapati et al. 2015). Also, the cases of robbery were witnessed in the temporary shelters, and the concerns of privacy and security were severe among women, where male members were found to be guarding the shelters at nights(Uddin 2016). Similarly, the absence of male family members was deeply felt by many migrant-sending households (Sijapati et al. 2015). Hence these factors could be assumed to have influenced the prospective male migrants more than women migrants to decide against the foreign labour migration.

2 Underlying Theories

2.1 Sudden Disaster and international Labour Migration

Policymakers, public institutions, and scholars on environmental migration argue that a sudden environmental event can be both directly and indirectly associated with leading the victims towards migration decisions. However, some call the attention towards the possible influence of various non-environmental variables in this relationship too (Castles & Miller 2009, Parnell & Walawege 2011, Black et al. 2011). Amidst the debate, some recent studies agree that this relationship shares the interaction of both environmental as well as non-environmental factors that often obtains complex multi-disciplinary[8] and also cross-cutting[9] linkages (Black et al. 2011, Neumann & Hilderink 2015, Koubi et al. 2016, Queiroz et al. 2019, Raleigh et al. 2008).

Consequently, various cross-disciplinary factors have been recognised on the cause side. Also, the varieties of human migration decision patterns have been observed on the effect side[10] (Neumann & Hilderink 2015, Pathak et al. 2016, de Moor 2011, Sijapati et al. 2015, Thornton 2011, de Moor 2011b). Among these, though environmental migration response in the form of internal household displacement, international migration, and internal labour migration, and also the return migration Black et al. (2011), Landry et al. (2007), Koubi et al. (2016), Queiroz et al. (2019), Mallick & Siddiqui (2015), Paul (2005), Paul & Routray (2010), Raleigh et al. (2008), Sagynbekova (2017), Castles & Miller (2009), Parnell & Walawege (2011), Neumann & Hilderink (2015) has been widely discussed and studied, only few have concentrated on the international labour migration. For example, (de Moor 2011, Thornton 2011, de Moor 2011b) shed light on the relationship between the environment and the international labour migration through qualitative methods. They commonly conclude and recommend international labour migration as a potential disaster recovery strategies for the policymakers in the context of developing countries. Nevertheless, they still do not cover a general question; "how might the human decision for the potential international labour migration be affected in such context?."

[8] Black et al. (2011)identifies five families of drivers which affect migration decisions: economic, political, social, demographic and environmental drivers.

[9] Some indicate that there could be both encouraging as well as discouraging effects of a same causal mechanism. For instance, economic motive drives the labour migration decisions, but it can also influence not to leave because of the increasing employment opportunities in the home country, especially in the reconstruction and rebuilding (Pereira 2009, Noy & Vu 2010, CBS 2011)

[10] For instance, some people might just walk a few yards through refuging with their friends or relatives, some might cross the international boundaries to flee disaster in the extreme case Queiroz et al. (2019), or some respond with return-migration (Landry et al. 2007).

Furthermore, "how might the impact differ across male and female, and in the context of a labour exporting, and disaster-prone country?". Hence, the question remains "is the international labour migration a suitable and demand/citizen-centric post-disaster employment policy solution?". Because of this knowledge gap, there is a lack of clarity on "how might developing country prepare in terms of labour market management and facilitation before and after the disaster? and in particular, "how a disaster-prone and labour exporting developing country react in such scenario?" Besides, Henry et al. (2004) reached nearest to this quest. They conclude that "international temporary migration was less common among the males" following a severe rainfall deficit in the context of Burkina Faso. However, the study uses data from various surveys, and for the analysis, they use statistical modelling. Unlike this, this paper uses causal modelling, on a recent observational time-series data, and I choose a case of disaster-prone, labour exporting developing country.

Nepal is a disaster prone[11] NPC (2015), labour exporting MoLESS (2020), developing county in South-Asia. The country is also prone to various forms of natural disasters. The recent large scale environmental catastrophe experienced by the country was 7.5 magnitudes massive earthquake of 2015[12]. These events claimed around 9,000 lives and more than 22,000 were injured. Approximately 712,000 homes and infrastructures were damaged. Though there is not enough evidence suggesting international displacement after the shock (IoM 2018), it compelled around 2.6 million people to flee their homes (Bilak et al. 2016).

Nepal's nationwide labour migration outflow was in the increasing trend until the end of 2014, whereas it showed a significantly decreasing trend in the post-earthquake period MoLESS (2020). District level database from the highly affected districts also resemble the similar characteristics[13]. Predictably, several studies were carried out in the post-earthquake Nepal, centring around the disaster-induced internal migration (He et al. 2018, Pathak et al. 2016, Uddin 2016, Wilson et al. 2016, NPC 2015). Yet, a few post-earthquake reports published by the local governmental, non-governmental as well as some international aid organisations

[11] A study conducted in two flood-prone villages in Bangladesh concludes that "people in an area with low flooding and with better socioeconomic circumstances are more likely to cope with impacts compared to people in areas with high and sudden flooding". This indicates that labour migration behaviour might vary across the degree of disaster proneness(Paul & Routray 2010).

[12] The first earthquake was followed by more than 300 aftershocks over 4.0 magnitude, another 6.8 magnitudes earthquake stroke Nepal after 17 days with the epicentre near the Mount Everest(NPC 2015).

[13] While 5268 labour permits were issued to prospective migrants labours from the 14 severely affected districts in two months before the shock, the number decreased by 15 per cent to 4480 by mid-May, 2015 (Sijapati et al. 2015).

(Gurung 2018, Maharjan et al. 2016, DOFE 2017, Sijapati et al. 2015) attempted to establish both direct as well as an indirect multi-causal relationship to explain the sudden change. Those arguments varied from the economic reasons, security issues, political, to psychological angles.

2.2 Neo-classical Economic Viewpoint

From the general trend, it is evident that the impact of Nepal's 2015 Earthquake on the country's labour outflow was contrasting to the neo-Malthusian arguments on environmental migration. Mainly concentrated on the economic motivation of the victims, neo-classical economists argue that environmental migration, in general, is a survival strategy in the post-disaster period (Myers & Kent 1995, Paul 2005, Walsham 2010, Koubi et al. 2016, Sagynbekova 2017, Thornton 2011). It can also be a risk minimising strategy and an essential tool for the diversification of the livelihood options among the affected population (Myers & Kent 1995, Paul 2005, Koubi et al. 2016, Sagynbekova 2017, Thornton 2011, de Moor 2011,b). As the earthquake disrupted almost all sects of the economy including trade, transport, production, tourism, and agriculture for months and inflation spiked,[14] in post-earthquake Nepal, it was apparent to predict the surge in labour outflow from the country. However, the surprising decline left many questions unanswered.

One argument to explain this change from the economic viewpoint could be that the immediate financial loss, might have triggered a priority shift. In support to this, a report concludes, building a new house and accumulating necessary goods and items to cope back to the everyday life was a primary priority among many victims (Sijapati et al. 2015). It is important to understand that international labour migration is often costly because of visa costs, ticket fares, and other immigration procedure involved. Though it is often against the policies in the home countriesDOFE (2015), data suggests that migrant workers from Nepal and some other developing countries often bear high recruitment cost depending upon various destinations, and the type of jobs (MDP 2020). Therefore, when families are struggling to recover from the substantial financial and human loss, investing for a overseas migration could be in the less priority (Sijapati et al. 2015).

In counter-argument, some spot that sudden environmental disaster might also attract new

[14]Data from January 2016 shows that the country's inflation picked at 12 percentage and up to 1 million Nepalis were estimated to be pushed into poverty in the FY2015/16 (WBG 2016).

employment and income opportunities in the origin of the disaster. It can create more jobs, especially in the relief works, reconstruction and rebuilding (Pereira 2009, Noy & Vu 2010, NPC 2015)[15] In the similar page, though Nepal faced sudden decline on economic growth at 2.7 percentage in 2016 WBG (2016), data suggests robust economic growth of Nepal after 2016, reaching up to 7.1 percentage in 2019 (WBG 2019). Among these, a recent preliminary report published by the Government of Nepal concludes that the reconstruction works contributed to increasing the country's GDP by 4.5 percentage points, after the earthquake(NRA 2019).

The economic argument also suggests an essential role of remittance in the post-disaster rescue, rebuilding, and livelihood (Savage & Harvey 2007). Likewise, remittances flows to Nepal too increased significantly by 27.6 percentage in three months after the shock, in comparison to the same period last year (WBG 2016)[16]. Like the literature suggests, such flow of remittance might have insured against the severity of the post-disaster shock. To explain the sudden drop in labour outflow from the remittance analogy, aspiring migrants from the remittance-receiving household can be assumed to drop their overseas dreams. Similarly, the role of foreign aid on supporting victims to regain its lost strengths after a disaster is equally exigent(Paul 2005). There are records of Nepal receiving an unprecedented amount of technical, financial and humanitarian aid from around the world (NPC 2015).

2.3 Analysing Multi-causal Influences

Recent studies on environmental migration have put increasing attention on the complex pattern of the causality. In addition to the economic argument, they have pointed towards the multi-disciplinary influence of disasters on individual's migration decisions. Consequently, security, political, psychological, social, demographic, and other similar factors are also being increasingly accepted as important motivators for environmental migration unlike in the past (Koubi et al. 2016, Paul 2005, Walsham 2010, Raleigh et al. 2008, Queiroz et al. 2019, Mallick & Siddiqui 2015, Neumann & Hilderink 2015, Black et al. 2011).

Among those, security and psychological factors can be assumed to have affected too many extents on the labour out-migration trend in post-earthquake Nepal. The percentage of total

[15]For instance, there is a historical evidence of European countries signing new bilateral labour agreements, to fulfil their increased labour demand for the rebuilding on the post World War II (Wickramasekara 2015).

[16]This was an exception because the inflow of remittance in other South-Asian countries was declining in the same period. Followed by this in 2017, the country became the fourth highest remittance recipient country as a percentage of GDP, in the world DOFE (2017).

labour permits issued to male migrants was 95 percentage in 2014 DOFE (2014), and it was around 91 percent in 2020 (MoLESS 2020). However, a lot of rescue and reconstruction work entails physical labour, and these works are often perceived as a men's job. Similarly, men are often trusted with the responsibilities of protecting vulnerable elderly, children, and women in the family at the time of crisis (Sijapati et al. 2015, Gurung 2018).[17] In the same vein, a report suggests that among the migrant-sending families that felt the absence of the migrant member, absence of male migrants was felt more (around 71 percentage) than the absence of female migrants (about 21 percentage) by their families (Sijapati et al. 2015). Likewise, despite the complicated and expensive procedures, there is evidence suggesting the return migration, and many failing to return despite the strong desire. These circumstances might have influenced the aspiring male migrants to rethink their migration decisions, which have possible effects on the out-migration trend (Sijapati et al. 2015). These factors also indicate that the impact of the earthquake can be assumed to be different across male and female.

Similarly, various political factors might have influenced the continuation of such vulnerabilities among the victims. For instance, a study conducted in 2018 suggested that because of the factors such as bureaucratic hurdles, political transition, and weak governance, many victims remained to wait for the relief up to three years after the shock (Sharma et al. 2018, Titz & Krüger 2015). This research assumes that potential migrants might have decided to stay to ensure the family against such vulnerabilities.

Analogously, lifestyle, culture, and some location-specific variables can also be assumed to have influenced the families choosing to live under the continued vulnerabilities and consequently affecting the labour out-migration trend. Since generations, the majority of rural Nepali households are built around an eco-system, where families own small scale agriculture farmlands, and their livelihood, as well as lifestyle, is designed and depended around it. Some reports suggest that the newly built settlements by the government and humanitarian actors faced the design failure because they could not understand and address these unique needs (Lal 2019). Thus, there was some evidence where victims choose to live on the original place of their habitat under the existing vulnerabilities despite being offered a new house on a community settlement for the free of cost [18] (Lal 2019).

[17] Temporary shelters also faced various security threats such as robbery and women reported the lack of privacy and security. Hence most men were found to be guarding the temporary shelters at nights(Uddin 2016).

[18] Association of the Nepalese living abroad spent 350 million in building Gupsi Pakha Settlement but have

3 Institutional Background on Nepal's Earthquake and Labor Migration

Here are some important information on the dependent and independent variables, and other unobserved hetero-geneity that could have diverse effects on the relationship. Varieties of difference-in-difference analysis frame works have been used in this research to control such time and district-invariant unobserved heterogenitiers.

3.1 Disruption in Existing Procedure vs Robust GDP Growth

The government of Nepal introduced a policy called "free visa, free ticket" in July 2015 for those migrating as international labour in seven destinations countries[19]. The new policy mandated the employing companies to bear the cost of visa fees and ticket fare of the potential migrant workers. However, this invited a dispute between the Government of Nepal's Department of Foreign Employment, and the foreign employment recruitment agencies because it curtailed their existing benefits. In response, a national strike was called for 18 days which disrupted the established operational procedure for out-migration (DOFE 2015). When foreign labour migration was becoming increasingly difficult, evidences suggest new economic opportunities created in the home country around the same period. Nepal has been experiencing robust economic growth after 2016, reaching 7.1 per cent in 2019[20] (WBG 2019). A recent preliminary report explains this change with increased economic activity in the reconstruction sector. It claims that on average, the reconstruction works increased the country's GDP by 4.5 percentage points, after the earthquake(NRA 2019). In a similar line, another nationwide survey carried out in 2017, reports that one in seven Nepali citizens and one in five male citizens were involved in construction-related works(NPC 2018). Thus, Nepal's significant economic growth can be assumed to have contributed to new employment opportunities within the country, while resulting in people choosing not to migrate.

failed to convince the families to live (Lal 2019).

[19]Those countries were Malaysia and, six others from the Gulf Cooperation Council (GCC); Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman. Up to 2014, these countries were the destination for around 85 percent of the migrant labours from Nepal DOFE (2014) and this trend continues till date(MoLESS 2020).

[20]Earthquake suppressed the projection of 4.6 percent GDP growth for 2015 by over 1.5 percentage points (NPC 2015) but the growth significantly increased after that (WBG 2019).

3.2 New Constitution 2015 and Elections 2017

In Septemeber 2015, Nepal promulgated a New Constitution for the Federal Republic of Nepal. It proposed a multiparty federal decentralised parliamentary system with three levels of governance and was written by the people's representatives, for the first time in the country's history. Some claim that this event has potentially signalled hope for the stable elected government, localised development, end of feudalism and a new beginning of democratic socialism (Bhattarai 2015). Following this in 2017, Nepal held three tiers of elections under the provisions of the 'Constitution of Nepal-2015; local governments, provincial assembly, and the federal parliament electing thousands of representatives in all levels(Khalid & Chughtai 2017). After the long history of monarchy and the decade long Maoists insurgency period, this also meant increased hope for the sustained peace, decentralisation, sustained elected government, increased rights and liberty, massive political reform and restructuring Dahal (2017) which might have affected the migration decisions among the aspiring Nepali migrants. Hence this new environment of political transformation and hope for change could have possibly influenced the aspiring migrants to rethink on their migration decision.

3.3 Economic Blockade 2015

Amidst the new hope for change, Nepal's new constitution was also criticised for not addressing the demands of marginalised Madhesis and Tharus. This triggered the Madhesh Movement; mainly a general strike across Indian borders. Stating its security concerns, the Government of India pressurised the government of Nepal to appear under the terms with the protesting group. However, Nepal perceived this step as 'an external interference in internal affairs' and accused India of the unofficial economic blockade. Thus, more than two months-long unrest in the border area from the strike, and Nepal- India diplomatic turmoil led into the severe national crisis (Sood 2016). Most importantly, the top 10 origin districts[21] of Nepali international migrant workers were also on the same region. In 2015, these ten districts accounted for 36.2 percent of all labour permits issued in the past seven years (DOFE 2015). Since Nepal is a landlocked country and is dependent on India for petroleum, the general strike had particularly hit the transportation sector (Sood 2016). Therefore, it was impossible to travel to the coun-

[21] Dhanusa, Jhapa, Mahottari, Morang, Siraha, Nawalparasi, Sunsari, Saptari, Rupandehi and Sarlahi

try's only international airport in the capital Kathmandu without transportation. In addition, safeguarding responsibilities of the women, children and older adults during the time of such political uncertainty, and civil unrest might have influenced potential male migrant to choose to stay over the migration.

3.4 Weak Oil Price and Trouble in Malaysia

In one hand, the global crude oil price fell sharply between 2015 to 2016. This weakened the economy of the major remittance sending Gulf countries too WBG (2016) increasing the probability of restricted hiring and even repatriation of the existing international workers from these countries (WBG 2016, DOFE 2017). On the other hand, Malaysia became the highest labour receiving countries from Nepal in 2014 with 42.14 percentage share in total labour permits issued DOFE (2015) but this share drastically dropped to 14.62 percentage in 2016 (MoLESS 2020). DOFE (2017) explains this sudden drop on the outflow to Malaysia as a potential consequence of Malaysia signing a bilateral labour agreement with Bangladesh in 2016 (DOFE 2017). Since, Nepal did not have such agreement, until 2018 MoLESS (2020), Malaysian employers might have preferred migrant labours from Bangladesh over Nepal (DOFE 2017). Additionally, poor working conditions and exploitation of Nepali migrant labours in Malaysia could be another potential reason for the drop. A survey among the returnee migrants from Malaysia, India, and GCC countries, the highest number of Malaysia returnees reported 'disability', 'injury or sickness', and 'removal from work' as a primary reason for their return in 2018 (NPC 2018). Similarly, among all destination countries, Malaysia reported the highest number of deaths from suicide and heart attack (MoLESS 2020).

4 Data

In the year 2014, 2015, 2017, and 2020 the Government of Nepal, Ministry of Labour Employment and Social Security has published detailed reports on the status of Nepalese international migrant workers. Most particularly the Department of international Employment (DoFE) functioning under the ministry, is the responsible government body dedicated to Nepal's international employment sector. The department is an authorised institution for issuance of the work permits to the Nepali citizens willing to work abroad (DOFE 2014, 2015, 2017, MoLESS 2020).

District-level data on the work permits issued, from the year 2010/11 to 2016/17 has been collected and compiled from the series of these reports.

National Reconstruction Authority, an autonomous body, established in the aftermath by the government of Nepal, has published various data covering all aspects of the 2015 earthquake in its official website (NRA 2020). Most information relevant to this research were collected and compiled from this credible source. Out of the countries 75 districts, 14 affected districts were declared "highly affected" from the earthquake. (NPC 2015). Thus, as a treatment variable, severely affected districts were given the dummy value '1' whereas 'o' otherwise.

In November 2012, the government of Nepal, National Planning Commission Secretariat and Central Bureau of Statistics[22] jointly published a national report titled "National population and housing census 2011 (CBS 2011)." From the report, data on the district-level population projection has been used in this paper. The logarithmic transformation of the ratio on international labour migration to the population for each district was used as the outcome variable.

5 Models

5.1 Cluster-robust Difference-In-Difference Method (DID)

I begin the analysis with three different models, namely, difference-in-difference method (DID), difference-in-difference model with district and year fixed effects (FE DID), and difference-in-difference model with the interactive fixed-effect model (IFE).

The difference-in-difference method explains the changes in international labour migration in severely affected districts compared with the remaining Nepalese districts.

$$Y_{it} = c + \delta D_{it} + \varepsilon_{it} \tag{1}$$

Where i and t are district-level and year-level indicators. Y_{it} is the dependent variable (outcome variable), which is the logarithmic transformation of the ratio of international labour migration to the population for each district i for each year t. c is the intercept. D_{it} is the exogenous treatment indicator (treatment variable) and equals 1 for the severely affected district

[22]The Central Bureau of Statistics, Nepal is a central governmental agency for the collection, processing, analysis, publication, and dissemination of official statistics in Nepal. It is also primarily responsible for the publication of "National Population Census of Nepal" in every ten years. The 2011 census is the most recent of all (CBS 2020).

in Nepal by the earthquake of April 2015 and equals 0 otherwise. δ is the average treatment effect, which explains the changes in international labour migration in the severely affected district compared with the remaining Nepalese districts.

5.2 Cluster-Robust Difference-In-Difference Method (DID) with District and Year Fixed Effects

The equation 1 is a simple correlation between treatment and outcome variable, and does not account for the district and year fixed effects. I would like to control all the possible variables that could affect or covaries with the outcome variable (note treatment variable is exogenous). However, such an endeavour is not feasible in this study mainly because the district level data is unavailable for Nepal. The results can be contaminated by hidden or omitted variables, resulting in an omitted variable bias. However, in the panel data set, fixed-effects models allow the removal of omitted variable bias by measuring changes within groups across time. Hence, controlling for year-specific fixed effects and district-specific fixed effects is important to absorb the shocks whose impact is restricted to a given year and district. Equation 2 includes these fixed effects.

$$Y_{it} = c + \gamma D_{it} + \alpha_i + \varsigma_t + \varepsilon_{it} \tag{2}$$

Where, α_i and ς_t are additive district-specific and year-specific fixed effects. γ is the treatment effect that explains the changes of international labour migration in the severely affected district compared with the remaining Nepalese districts after controlling for time and district-invariant unobserved heterogeneity.

5.3 Cluster-Robust Difference-In-Difference Method (DID) with Interactive Fixed Effects

One of the main challenges of this research is the time-varying unobserved heterogeneity. Note that unobserved time-varying heterogeneity should not be confused with time-fixed effects. Time-specific fixed effects are shocks which impact is restricted to a given time, for example, some natural disasters. Allowing unit-specific trends control for the exogenous trend in the dependent variable is not explained by other variables. For example, there could be nationwide

time trends in international labour migration.

Unlike previous studies that directly imposed unit-specific linear or quadratic time trends in conventional two-way fixed effects models, I allow a flexible and explicit modeling non-linear time-varying heterogeneity using a two-way fixed effect model augmented with interactive fixed-effect models (IFE) (Bai 2009). IFE model allows us to control for the nationwide time trends in the dependent variable, migration, in which different districts are either more or less susceptible, depending on the unobserved characteristics of those districts. The IFE model can be expressed as:

$$Y_{it} = \phi D_{it} + \alpha_i + \varsigma t + \lambda_{it} F_{rt} + \epsilon_{it} \tag{3}$$

where, F_{rt} is an unobserved factor that is common across all districts in each year t and λ_{it} represents district factor loading, which is constant over time and represents how susceptible each district is to international labour migration. ϕ is the average treatment effect that explains the changes in international labour migration in the severely affected district compared with the remaining Nepalese districts after controlling for time and district-invariant unobserved heterogeneity and time-varying unobserved heterogeneity. All remaining notation has the same interpretation as in equation (1) and (2).

In each of equation 1, 2, and 3, I consider three types of international labour migration. These are the logarithmic transformation of the total, male, and female international labour migration to population. Consistent with X, Y, and Z theory, one should expect a negative and significant value of δ, γ, and ϕ, which would suggest the earthquake of April 2015 has a role in reducing international labour migration. However, a positive and significant δ, γ, and ϕ can provide evidence that sudden events like the earthquake of April 2015 can increase the international labour migration, consistent with theory A, B, C.

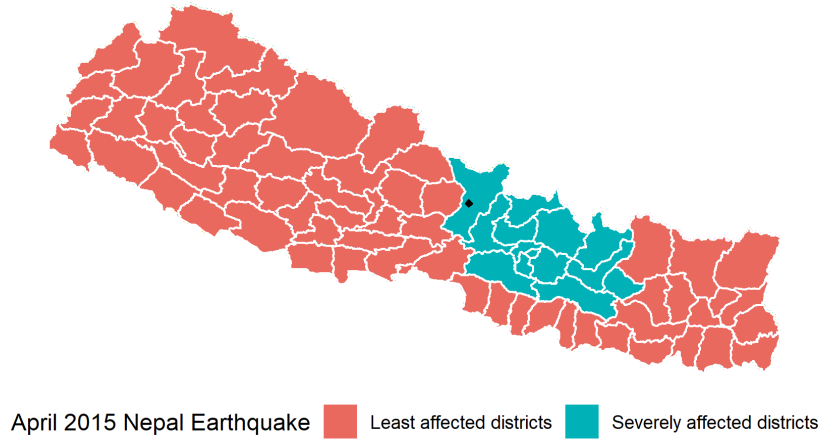
All of the regression presented in this section have clustered standard error at the district level to allow for an arbitrary autocorrelation process within district (Bertrand et al. 2004). Furthermore, the standard errors are robust to heteroskedasticity. Hence these estimates are cluster-robust and therefore highly conservative.

6 Results

6.1 Descriptive analysis

I begin this analysis by exhibiting a cheolerpetra map of severely affected and least affected districts from the April 2015 earthquake in Figure 1. The Nepal government's NRA (2020) defines these district level severity of the April 2015 earthquake of Nepal. Black dot, in Figure 1, marks the epicentre of April 2015 Nepal Earthquake at the east of Gorkha District at Barpak, Gorkha. Districts in south-east proximity of the epicentre are severely affected by the April 2015 earthquake of Nepal.

Figure 1: Severely Affected Districts from April 2015 Nepal Earthquake

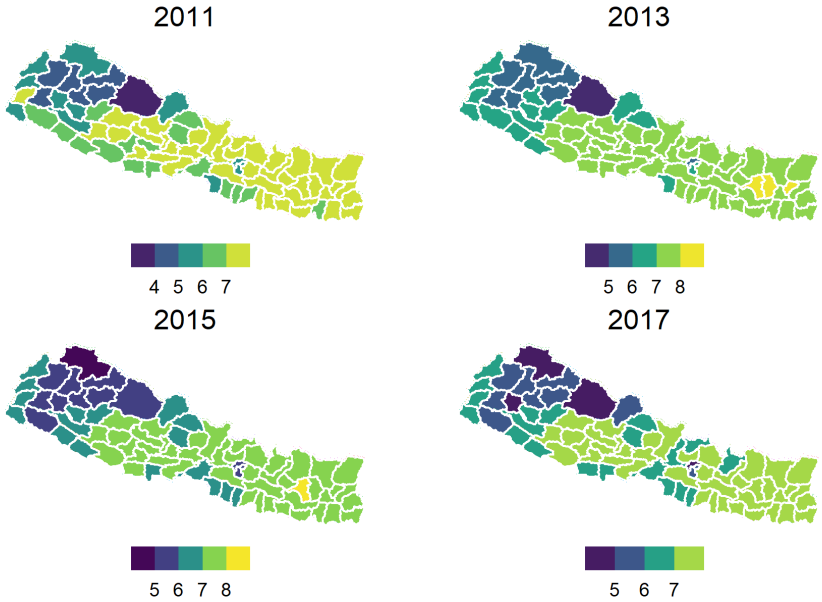


Notes: Black dot marks the epicentre of April 2015 Nepal Earthquake at the east of the Gorkha District at Barpak, Gorkha. Nepal government NRA (2020) lists the severely affected districts as Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. The top is directed toward North direction.

In Figure 2, I present the Spatio-temporal Variation of logarithmic transformation of the ratio total international labour migration to the population. Figure 2 comprise four panels for 2011, 2013, 2015, and 2017. The north-western districts and three main districts in the Kathmandu valley, namely Kathmandu, Bhaktapur, and Lalitpur, have less international labour migration than the eastern part of Nepal. For readers, I also develop a similar plot for male and female international labour migration in Appendix A.

In Figure 2, compare to 2011, for 2013, there is an increase in total international labour migration. However, even though there are district-level heterogeneities, for the years 2015 and 2017, there is a decline in total international labour migration. Potentially there can be two explanations for such a trend. First, is the change in population size compared to the labour

Figure 2: Spatio-temporal Variation of Total international Labor Migration to the Population



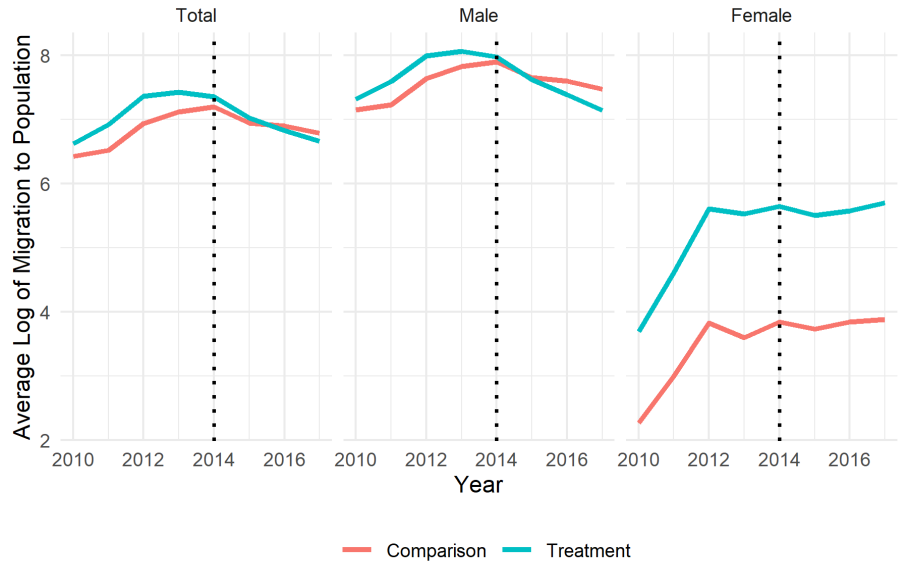
Notes:

migration. The World Bank reports negative annual population growth rate of Nepal for year 2012 (-2%), 2013 (-1%), 2014 (≈0%) and positive annual population growth rate for year 2015 (0.4%), 2016 (0.9%), 2017 (1.3%). Second is that the migration rate is declining over time, and it appears, at least at the district level.

In Figure 3, I exhibit how the average trend of international labour migration among the district that is severely affected by the 2015 earthquake (treatment districts) is different from the other remaining districts (comparison districts).

Figure 3 exhibits the average of the log of the total, male, and female migration to total, male, and female population ratio both treatment districts and comparison districts from 2010/11 to 2016/17 Nepalese year. The vertical dotted line divides the year into pre and post-earthquake periods. For the pre-earthquake period, Figure 3 exhibit the parallel trend of migration for treatment and comparison district. However, post-earthquake periods, there is some divergence of overall and male migration. The female migration seems not to be affected by the earthquake. I further examine these relationships with the DID, DID FE, and IFE model in the next Table 1.

Figure 3: General Trend of International Labour Migration, Across Male and Female



Notes: Nepal government's NRA (2020) lists the severely affected districts as: Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. I define the severely affected districts as treatment group and remaining districts as comparison group. The Dotted horizontal line

Table 1: Effect of Earthquake in international Labour Migration

Variables	Panel A: Total Migration			Panel B: Male Migration			Panel C: Female Migration		
	DID (1)	DID FE (2)	IFE (3)	DID (1)	DID FE (2)	IFE (3)	DID (1)	DID FE (2)	IFE (3)
D	0.09	-0.321***	-0.378***	-0.045	-0.401***	-0.414**	1.967***	0.096	-0.164
	(0.213)	(0.057)	(0.074)	(0.232)	(0.061)	(0.112)	(0.219)	(0.07)	(0.12)
Intercept	6.879***		6.922*** (0.1)	7.579***		7.613***	3.64***		3.838***
	(0.104)			(0.107)		(0.103)	(0.157)		(0.16)
District FE		✓	✓		✓	✓		✓	✓
Year FE		✓	✓		✓	✓		✓	✓
Factor			1			1			1
HC1	✓	✓		✓	✓		✓	✓	
Bootstrap SE			✓			✓			✓

Notes: Nepal government's NRA (2020) lists the severely affected districts as Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. I define the severely affected districts as the treatment group and remaining districts as a comparison group. The Dotted horizontal line

6.2 Main results

Table 1 provides three panels, each representing the relationship of the impact of the 2015 Nepal earthquake on total migration (Panel A), male migration (Panel B), and female migration (Panel C). Each panel comprises three different models, Difference-in-Difference model (DID), Difference-in-Difference model with district and year level fixed effects (DID FE), and Interactive

Fixed Effect model (IFE) in column (1), (2), and (3) respectively. Treatment indicator or the post-earthquake is represented as D as shown in equation 1, 2, and 3. To account for the intra-district correlation, I clustered the standard error at the district level for all models. The standard errors are also robust to heteroskedasticity for DID and DID FE. However, for IFE, I generate standard errors based on nonparametric bootstraps (blocked at the district level) of 2,000 times. In DID and IFE model, the intercept shows the average value of migration among comparison district, while the treatment effect D show by how much the migration level differs in treatment district with regards to comparison district.

The DID estimates in Panel (A) column (1) exhibit a treatment effect of 0.09; however, the DID FE estimates the statistically significant value of -0.321, indicating an overall reduction of migration in the post-earthquake among treated district to comparison district. The flip of sign from DID estimates to DID FE shows the importance of absorbing the shocks whose impact is restricted to a given year and district. The estimate of DID in column (1) is a simple correlative analysis. The flip of sign suggests there is some hidden structural difference that DID is unable to account, but DID FE able to capture. Yet as a researcher, I do not know what kind of shock does the DID FE captured.

There are possibly two ways to think regarding this situation. First is possible there was a nonlinear nationwide natural trend or inertia in the migration which could have evolved from the unobserved heterogeneity, for that, I can use IFE model to capture such nationwide trend in migration in which different districts are either more or less susceptible, depending on the unobservable characteristics of those districts. The IFE estimates projects the slightly stronger estimates than the DID FE but in the same direction. The IFE estimates in Panel (A) column (3) provides statistically significant estimates of -0.378, suggesting a reduction of total migration in the severely affected district from earthquake compared to comparison districts. I have made further analysis of nationwide natural trend or inertia in the migration and district-level susceptibility to such a national trend in Figure 4 and 5.

Second, migration varies structurally between male and female in Nepal. Male are primary breadwinners, and women have the equally important task of household chores and caring for the family, mainly children and the elderly. For this matter, I produce Panel B and Panel C to investigate how male and female international labour migration are affected. The table

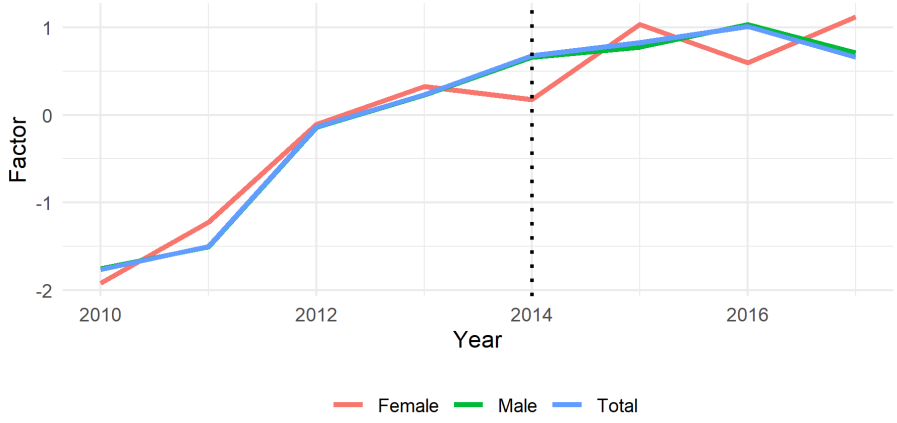
structure is the same as Panel A.

Panel B provides estimates of male international labour migration estimates. Unlike Panel A, the estimates of Panel B are consistent in sign. The DID estimate is statistically insignificant. However, the DID FE and IFE converge to the statistically significant similar estimate of ≈-0.40, indicating a considerable reduction of male international labour migration in the severely earthquake affected district compared to a comparison district. However, the results in Panel C, in which estimates of female international labour migration are inconsistent with DID FE and IFE being statistically insignificant, suggesting that female labour migration remains unaffected. Note the nature of female labour migration is different than that of male labour migration.

6.3 Nationwide Nonlinear Trend of international Labor Migration and District Level Susceptibility

In each IFE model in Table 1, I try to capture nonlinear nationwide natural trend or inertia in the migration and the district level susceptibility to such a nationwide trend. I explain these concepts further in Figure 4 and 5 respectively.

Figure 4: Factor: Nationwide Non-linear Inertia of international Labor Migration

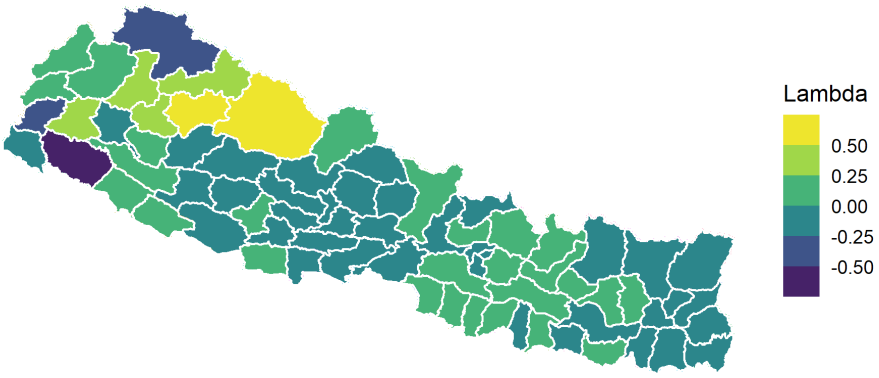


Notes: Nepal government's NRA (2020) lists the severely affected districts as: Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. I define the severely affected districts as treatment group and remaining districts as comparison group. The Dotted horizontal line

Figure 4 presents the nonlinear nationwide trend in the total, male, and female international labour migration. It appears these trends are increasing in decreasing order. The female international migration trend seems to follow annual cyclical behaviour. However, total and male international labour migration are perfectly correlated. Though there is this national

trend, different districts are differently susceptible to the national trend, see Figure 5.

Figure 5: Lambda: District Level Susceptibility on the Nationwide Non-linear Inertia of international Labor Migration, Total.



Notes: Nepal government's NRA (2020) lists the severely affected districts as Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. I define the severely affected districts as the treatment group and remaining districts as a comparison group. The Dotted horizontal line

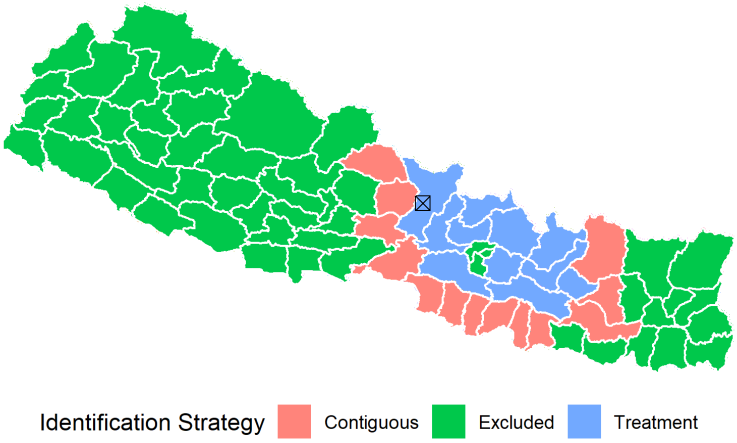
Figure 5 provides a cheolerpetra map of district-level susceptibility to the nonlinear national trend in migration. These are relative scales. District with darker/lighter colour is less/more susceptible to the nationwide trend depending upon the district level unobservables.

6.4 Falsification checks

In the analysis in Table 1, this identification strategy was to compare the international labour migration of severe earthquake-affected districts with all the remaining districts. However, international labour migration of the district far away from the earthquake epicentre is plausible to be less affected. Furthermore, this division of treatment and comparison districts are based on the NRA (2020) classification. However, the tremors of the earthquake know no district boundaries. In addition to that, Kathmandu, Bhaktapur, and Lalitpur district are listed in severely affected districts, but these districts are less reliant on international labour migration. For that matter, in the following analyses, I try to falsify the main results. For this, I utilise a different identification strategy. Unlike in the main results, here I change the comparison and treatment district; see Figure 6.

Figure 6, I graphically depicted the redefinition of treatment and comparison district. Here, I redefine the treatment district as per the definition of NRA (2020); however, I exclude Kath-

Figure 6: Spatial Identification Strategy



Notes: Nepal government's NRA (2020) lists the severely affected districts as: Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. I define the severely affected districts as treatment group and remaining districts as comparison group. The Dotted horizontal line

mandu, Bhaktapur, and Lalitpur district. For the comparison, rather than taking the remaining district, I only consider the districts contiguous with the treatment district. Then I exclude all other districts from the analysis. This allows preventing the selection bias that may be induced either from the including the district, and those are far away from the epicentre, or including districts like Kathmandu, Bhaktapur, and Lalitpur. Then I re-estimate DID, DID FE, and IFE model for total, male, and female international labour migration in Table 2.

Table 2: Effect of Earthquake in international Labour Migration, Spatial Identification Strategy

2[4]*Variables	Total Migration			Male Migration			Female Migration		
	DID	DID FE	IFE	DID	DID FE	IFE	DID	DID FE	IFE
D	0.072	-0.245*** (0.067)	-0.275	0.004	-0.299*** (0.07)	-0.28	1.532***	0.04 (0.076)	-0.01
	(0.108)	(0.067)	(0.323)	(0.126)	(0.07)	(0.311)	(0.259)		(0.181)
Intercept	7.285***		7.365***	7.953***		8.019***	4.358***		4.711***
	(0.102)		(0.111)	(0.115)		(0.102)	(0.249)		(0.234)
District FE		✓	✓		✓	✓		✓	✓
Year FE		✓	✓		✓	✓		✓	✓
Factor			1			1			1
HC1	✓	✓		✓	✓		✓	✓	
Bootstrap SE			✓			✓			✓

Notes: Nepal government's NRA (2020) lists the severely affected districts as Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. I define the severely affected districts as the treatment group and remaining districts as a comparison group. The Dotted horizontal line

Table 2 follows same structure as Table 1. DID estimates are correlative. However, they provide us with a quick overview. The IFE models are less suited in this analysis because I

only include the sub-sample. Therefore, nationwide trend analysis is not appropriate. For that matter, I exclude interpreting the results of DID and IFE but put the result in the table to remain consistent with the result format.

The DID FE estimates for total migration, and male migration are -0.245 and -0.299. Both are statistically significant, suggesting a reduction of the total and male international labour migration in the districts contiguous to severely earthquake-affected districts. These estimates are not as pronounced as the estimates from Table 1. Still, they are more likely to free from selection bias induced either from the including the district that is far away from the epicentre, or including districts like Kathmandu, Bhaktapur, and Lalitpur. Thus, the falsification analysis seems to support the existing hypothesis, i.e., sudden environmental event reduces the outflow of international labour migration, in the context of disaster-prone and labour exporting developing country like Nepal.

7 Discussion and Conclusion

Human migration, as a response to environmental events, has been studied and accepted by so many academics (Queiroz et al. 2019, Koubi et al. 2016, Paul 2005, Raleigh et al. 2008). Despite the progress, the pattern of the human decision on the international labour migration as a response to sudden disasters has often been missed out from the empirical analysis on environmental migration. Because of this gap, there is only limited knowledge on "how does a sudden disaster impact on the country's existing labour outflow in general?" making it unsettling for the labour market policy planning before and in the aftermath. As a lack of availability of accurate and detailed data is a common challenge that researchers often face in the context of disaster-prone developing countries, the response pattern in those countries is even more difficult to understand.

Thus, this research gathers and analyse various related academic literature and facts and points out the complex, multi-disciplinary pattern of causality. It points out that neo-classical economic argument on environmental migration might influence, as well as discourage international labour migration. In addition, this paper also calls attention to various cross-cutting multi-causal influences on the individual's decision to post-sudden disaster international labour migration in the context of a disaster-prone developing country. After careful considerations

and critical analysis on the existing knowledge, it assumes that in overall, sudden environmental events might affect adversely rather than positively to the outflow of international labour migration especially in the case of disaster-prone labour exporting developing countries like Nepal.

To empirically test the derived hypothesis, this research gathers relevant data from various official sources and analyses three different frameworks; difference-in-difference (DID), difference-in-difference with district and year fixed effects (FE DID), and difference-in-difference with the interactive fixed-effect (IFE). With the difference-in-difference model, first of all, it examines the simple correlation between treatment and outcome variables, and do not account for the district and year fixed effects. Secondly, to address the lack of availability of the district-level data, it uses the difference-in-difference technique with district and year fixed effects (FE DID) which removes the omitted variable bias. Thirdly, it uses a two-way fixed effect augmented with interactive fixed-effect to control for the nationwide time trends in the dependent variable. Finally, it uses all three frameworks to examine the relationship between 2015 earthquake on Nepal's total out-migration (A), male migration (B), and female migration (C) respectively.

In model (A), the difference-in-difference technique with district and year fixed effects (FE DID) and most importantly, a two-way fixed effect augmented with interactive fixed-effect (IFE) showed a statistically significant relationship between the dependent and independent variables. It suggested that there was an overall reduction on the outflow of the international labour migration among highly affected districts in comparison to other remaining districts in the post-earthquake Nepal. However, the difference-in-difference technique (DID) showed a treatment effect of 0.09 with an unexplained flip in the sign. Similarly, in the model (B), the second (FE DID) and third (IFE) techniques exhibited a considerable reduction of male international labour migration in the severely earthquake affected district compared to comparison districts. Unlike in model (A), the signs were consistent across models, but the DID estimates were statistically insignificant. In contrast to these, model (C) showed a statistically insignificant relationship between the variables suggesting that female labour migration remains unaffected.

Likewise, this paper provides empirical evidence on the adverse impact of a sudden disaster on and the existing international male labour migration trend, where as no significant effect on the female out-migration. Labour migration is an important phenomenon in Nepal's history,

and it also has a significant contribution on the country's economy. However it is a disaster-prone developing nation and have been facing big scale environmental catastrophe in the the past. These unique and crucial components made Nepal a suitable case for the study of the impact of sudden environmental events on a country's existing international labour migration trend. However, policymakers in this niche (for example many other countries in South Asia who share similar characteristics such as Bangladesh, Sri Lanka, Pakistan, and India) can refer to the knowledge from this research, while forming post-disaster international labour migration policies.

Findings might be indicating the need for facilitation in creating in-house employment and income opportunities rather than expecting the out migration. It further suggests that these findings may apply to potential male foreign labour migrant but there must be a separate and unique approach while addressing the prospective female migrants. In the future, this research can be expanded to cross-national level, including other countries in the respective niche. Additionally, this research can be expanded across the range of other variables such as caste, ethnicity, and age group could be added to the study.

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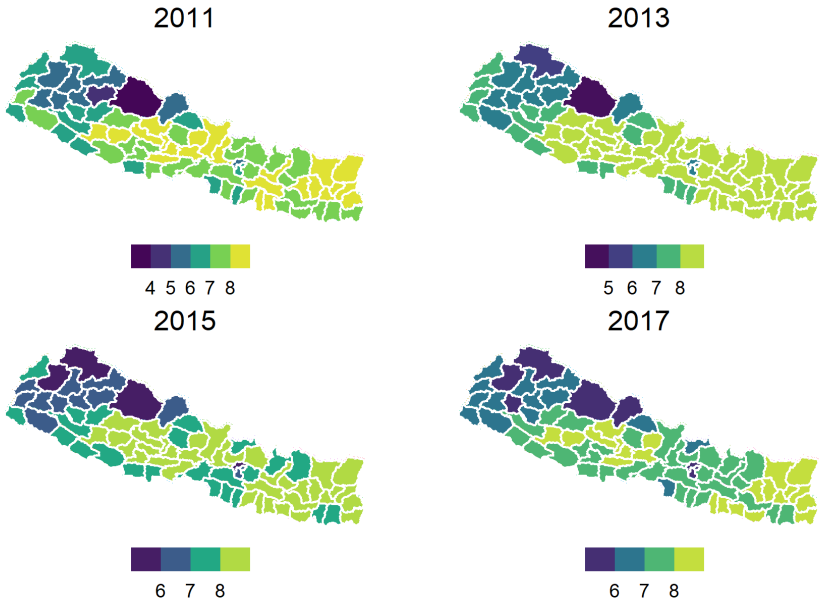
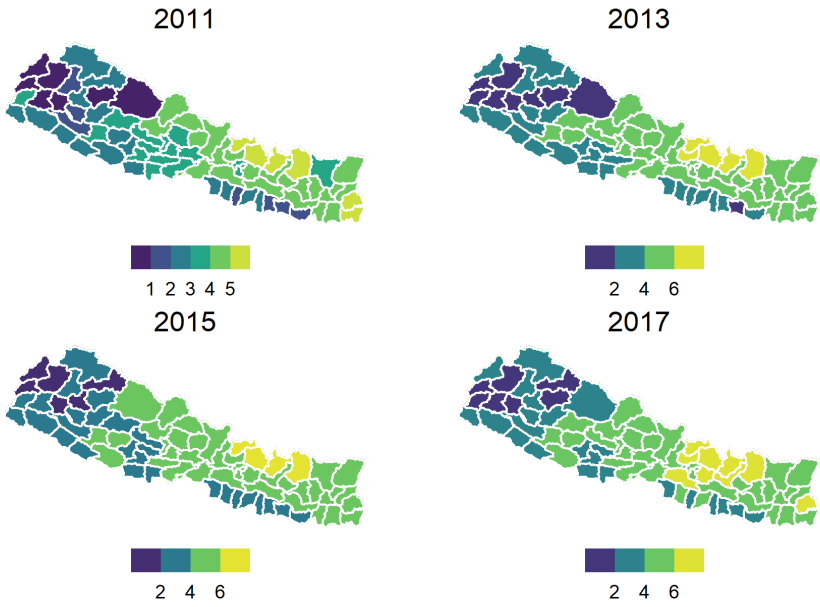
A Appendix A

Figure A1: Spatio-temporal Variation of Foreign Labor Migration (Male) to the Population



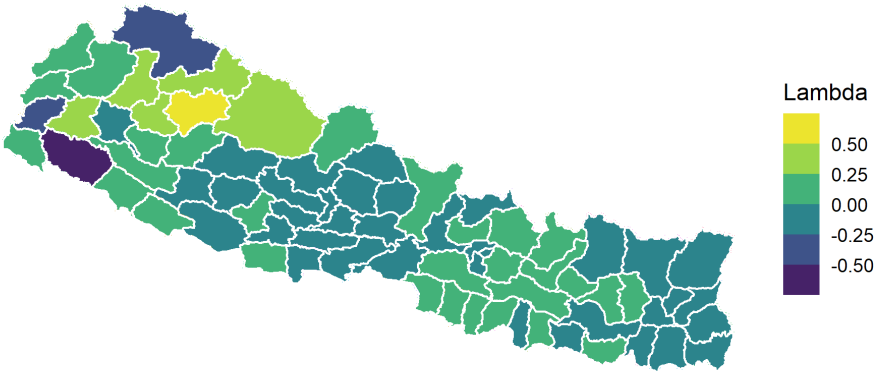
Notes:

Figure A2: Spatio-temporal Variation of Foreign Labor Migration (Female) to the Population



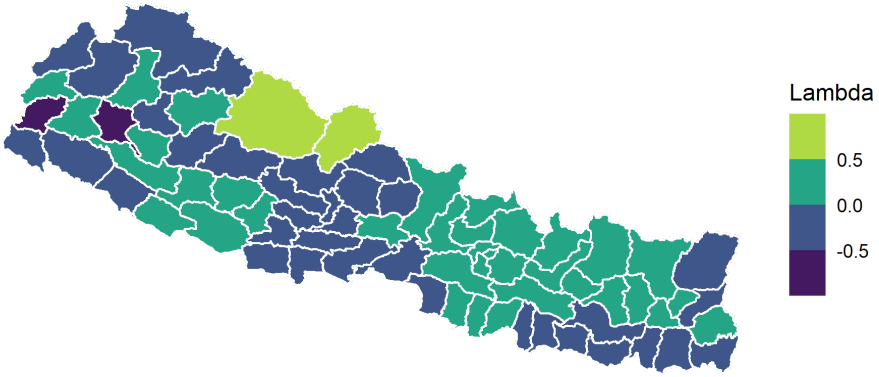
Notes:

Figure A3: Lambda: District Level Susceptibility on the Nationwide Non-linear Inertia of Foreign Labor Migration, Male.



Notes: Nepal government's NRA (2020) lists the severely affected districts as: Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. We define the severely affected districts as treatment group and remaining districts as comparison group. The Dotted horizontal line

Figure A4: Lambda: District Level Susceptibility on the Nationwide Non-linear Inertia of Foreign Labor Migration, Female.



Notes: Nepal government's NRA (2020) lists the severely affected districts as: Okhaldhunga, Dolakha, Ramechhap, Sindhupalchok, Kavrepalanchok, Sindhuli, Bhaktapur, Kathmandu, Lalitpur, Rasuwa, Nuwakot, Dhading, Gorkha, and Makwanpur. We define the severely affected districts as treatment group and remaining districts as comparison group. The Dotted horizontal line