

Do natural disasters open a window of opportunity for corruption?

Abstract

This study explores the link between natural disasters and corruption at the local government. We examine whether a natural disaster affects official households more favorably than non-official households. We find that natural disasters decrease nonofficial household expenditures significantly, however have negligible effect on official household expenditures. Meanwhile, both kinds of households experience similar reduction in incomes, and have much the same disaster coping strategies. Together, the results imply that local officials may receive unobserved monetary compensation – we define as corruption - in the aftermath of natural disasters.

JEL: Q3, H3, C2

Keywords: Corruption, local government officials, natural experiment, windfalls resources.

Introduction

Around 400 B.C, Kautilya in his ancient Indian political treatise Arthashastraⁱ offered a key following insight:

*"It is just as difficult to detect an official's dishonesty as it is to discover
how much water is drunk by the swimming fish."*

This insight is inline with Olken (2007) Banerjee et al., (2012) 's point that corruption studies face the challenge of finding an adequate comparison group and - an exogenous source of variation, which induces changes in incentives to engage in corrupt behavior. To address this challenge, our study jointly explores two emerging research areas: corruption and natural disasters. Our study focuses on local governments in Vietnamese communes. A novel aspect of this study is that it considers natural disasters an exogenous shock to the economic environment, which provides an incentive for corruption.ⁱⁱ

A natural disaster arguably influences corruption via three channels. First, in disaster time, consumption is low, the marginal utility of consumption is high, and thus the value of siphoning off public money is high. This logic is consistent with the finding in our study that local officials approximately smooth their expenditures. Second, government transparency may be worsened in the affected communes due to the collapse of infrastructure and the disorder that results from natural disasters. Officials may find it easier to engage in corrupt behavior under such circumstances. Finally, the occurrence of a natural disaster is usually accompanied with relief aid from the central government and/or other donating organizations. Given that officials are primarily responsible for handling relief funds, it is plausible for them to abuse such windfall resources for personal use.

Methodologically, given the lack of variables that measure corruption directly, following Gorodnichenko and Peter (2007) and Gorodnichenko et al., (2009) we apply the “forensic economics” approach to address the link between natural disasters and corruption.ⁱⁱⁱ Though there is a large literature on indirect approaches to quantify corruption, most existing works focused on “steady state” levels of corruption. We provide a novel insight into the corruption problem by exploring the “state-dependent” nature of corruption.^{iv} Specifically, we focus on the flow of disaster relief – which represents a one-shot disbursement of funds. This approach differs from a standard approach – which uses stream of government spending that is subject to embezzlement.^v

To identify the existence of corruption in affected communes, we examine whether the disaster has the same effect on income differential between official and non-official households as it does on the expenditure differentials. We conjecture that a similar effect on income of official and nonofficial households should lead to insignificant differences in the expenditure patterns. Yet, we find that disasters affect the expenditure of official households more favorably, while reduce their incomes just as much as nonofficial households. We attribute this discrepancy to corruption by officials in the affected communes.

An important aspect of natural disaster study is that households may have different coping strategies (Cavallo and Noy, 2011; Thomas et al., 2010). We are interested in whether official households have better coping mechanisms that help them achieve higher expenditures in the aftermath of natural disasters. The diversity of mechanisms makes it difficult to examine them all. Having a very comprehensive data set, however enables us to consider a broad range of coping mechanisms.^{vi} In particular, we examine whether remittances, savings, asset holdings, migrating behavior, and access to formal credit institutions are significantly different between official and nonofficial households, and between affected and unaffected communes.

We find that the differences in coping strategies are insignificant or only marginally significant. Both official and nonofficial households are affected equally by natural disasters, and both have the same coping mechanisms. Thus, one would expect their expenditures to also be affected equally by disasters. However, disasters seem to favorably influence local officials in affected communes. This result confirms the proposition that officials might receive unobserved monetary compensation in the aftermath of a natural disaster. We refer to this unobserved, non-reported compensation as corruption.

One may wonder why Vietnam is an ideal setting to study the link between corruption and natural disasters. According to a Corruption Perceptions Index (CPI) survey, Vietnam ranked 112th out of 183 countries. Corruption has almost become a matter that is taken for granted in daily life. Vietnam's central government has realized one of the main causes for the widespread nature of corruption; low salaries of government officials. Another reason for conducting this study in Vietnam is that the country is prone to a number of natural disasters due to its geographical location. Moreover, the disasters occur on a large scale. The nationally represented data (VNLSS) used in this study contains almost 50% of the households impacted by the disasters. Hence, a nice balance – in terms of sample size - between the treated (affected communes) and comparison (unaffected communes) can be established. Finally, while we study corruption using Vietnamese data, this phenomenon has to be quite general (almost any relief effort is accompanied by embezzlement scandals), and many readers will find the results in the paper broadly interesting.

We proceed with the remainder of the paper as follows. The next section summarizes related literature on corruption. Section 3 outlines the local context of corruption in Vietnam and argues that natural disasters and government relief aid could serve as a "natural experiment," which allows for evidence of the corruption associated with relief aid to be identified. Section 4 develops a simple model on corruption, building upon the agency

approach as in Becker and Stigler (1974). Section 5 describes the data set and empirical strategies, and section 6 presents the empirical results. We then conclude the paper and offer suggestions for the direction for future research.

2 Related Literature

In an excellent survey, Banerjee et al., (2012), and Cole and Tran (2010) indicate that researchers have not arrived at an acceptable measure of corruption because of its variety and secretive nature. It is likely because of this that only a handful of empirical studies on corruption exist. These few studies have developed rather innovative methodologies to tackle the challenge of studying corruption. In what follows, we focus on the most relevant studies.

An interesting strand of literature relates to the windfall resource hypothesis.^{vii} According to this hypothesis, officials may have a tendency to abuse public goods, such as disaster related relief funds. Broilo et al., (2012) in a study in Brazil find that an increased federal transfer results in greater political corruption. Applying the regression discontinuity design (RDD) approach, Querbin and Snyder (2011) suggest that rent extraction and corruption are more likely to occur during periods of political turmoil. Leeson and Sobel (2008) find a close correlation between corruption and natural disasters in the US: each additional \$100 per capita in Federal Emergency Management Agency (FEMA) relief aid increases the average state's corruption level by nearly 102 percent.^{viii} In a study on Peru, Maldonado (2010) estimates that the predicted probability of being asked to pay a bribe by a local public official, is reduced by 1.5-1.8 percentage points in districts experiencing a change in the prices of resources.

A “forensic economic” approach

Given the challenge of measuring corruption, a novel approach to study corruption is “forensic economic”. The key insight of this approach is that two measures of the same economic activity should yield similar results, at least in the absence of activity that is hidden from one of the measures. As such, using forensic economic approach enables us to identify patterns of statistical anomalies that may suggest corrupting behavior (Zitzewitz, 2011; Sequeira, 2012). Researchers have implemented this approach in various contexts including public and private sector workers (Gorodnichenko and Peter, 2007), the politics of firms (Fisman, 2001; Fisman et al., 2006), schooling (Jacob and Levitt, 2003), Summo wrestling (Duggan and Levitt, 2002), and the household poverty index (Camacho and Conover, 2009). Each study uses different approach to measure corruption. For instance, Olken and Barron (2009) use bribe payments to police officers, soldiers, and weigh station attendants to measure corruption. Reinikka and Svensson (2005) define the gap between data on Ugandan central government’s school appropriations and money that actually reached the schools – as a measure of corruption. Gorodnichenko and Peter’s (2007) study is most closely related to ours. They explore whether a difference in income between the public and the private sector would lead to similar differences in consumption patterns of public and private employees. The difference between these two patterns points to the existence of corruption.

In sum, most of the existing work focused on "steady state" levels of corruption. We provide a novel insight into the corruption problem by studying the "state-dependent" nature of corruption. We also improve upon the aforementioned studies’ identification strategy by focusing on the exogenous aspect of natural disasters.

3 Local corruption and natural disasters in Vietnam

In this section, we will briefly describe the political and social context within which local governance is situated. We then discuss features of natural disasters in Vietnam, and their

link with corruption studies.

3.1 Local Governance in the communes of Vietnam^{ix}

At the commune level, the People's Committee is the administrative unit elected by the People's Council to implement the policies proposed by the Council. In reality, the real power lies in the hands of the leaders of the Communist Party Organ of the commune, who often hold key positions in the Council, the Committee, and the Commune's Police Station (Malesky et al., 2013). There is very little separation between these bodies, and the operation of the Party Organ is usually kept out of the public scrutiny. As such, there are very few credible mechanisms to detect the embezzlement of public funds (Nguyen, 2009).^x Meanwhile, the use of an "efficiency wage" as the way to prevent corruption (Becker and Stigler 1974) has mostly not been in practice in Vietnam. In sum, the institutional arrangements and the tight public budget create fertile ground for corruption at the local level. In the next section, we will discuss how a natural disaster formulates an ideal setting to study corruption.

3.2. Natural Disasters generate an ideal setting to address corruption

Vietnam is endowed with abundant rainfall, a dense network of rivers, and an extensive irrigation system, which enables it to produce a wide range of crops, including rice and other cash crops. Vietnam is one of the major exporters of rice, coffee, tea and cashews. At the same time, Vietnam also has to cope with various natural disasters including floods, droughts, and typhoons, which can cause severe damage to its agriculture and aquaculture. Figure 1.1 presents the loss by natural disasters as a percentage of GDP over the years. We can observe a great deal of variance over the years reflecting the uncertain nature of natural disasters.

A relevant question to this study is whether the assignment of affected and unaffected communes is truly random. One may argue, for instance, that communes located near the rivers may experience more floods; likewise hurricanes may happen more frequently in the coastal areas. Yet, as can be observed in figure 1.2, each type of natural disaster tends to focus on a different location: floods occur in the delta region, hurricanes in the coastal region, drought in the highland region, and flash floods in the mountainous areas. Each commune in a given region has the same likelihood of experiencing the corresponding natural disaster. It is also worth noting the link between different types of natural disasters. For example, according to the Ministry of Agriculture's Central Committee for Flood and Storm Control, typhoons can affect around 80–90 percent of the population, including not only communes living along the long coastline, but also those living in the upland areas that are vulnerable to subsequent flashfloods resulting from the typhoons' heavy rains.^{xi} Put differently, natural disasters spread out across the whole country in such a way that a large number of communes have an equal chance of being impacted. In addition, Vietnam is next to one of the five routes of typhoons in the world, therefore the pattern of hydrometeorology is hardly anticipated (CCFSC, 2010).

To investigate whether there exists any significant difference between the communes, Table 1 presents primary statistics on demographic, geographical, and infrastructure characteristics of communes - according to whether or not they were affected by the disaster. In addition, the households' statistics on main demographic variables are presented in Table 2. We classify the household according to whether they are official households and whether they were affected by natural disaster. Overall, households share most of demographic characteristics including age, gender, and education. Our two main variables of interest are income and expenditures. Official households have higher incomes than nonofficial ones, though the difference is insignificant. This pattern is observed in both affected and unaffected

households. Also, affected households have lower incomes, thereby suggesting the negative impact of disasters on those households. As for expenditures, nonofficial households in the affected communes have a significantly lower level than their counterparts in unaffected communes. Put differently, the expenditure differentials due to the disaster's effects are consistent with income differentials among nonofficial households. Interestingly, we do not observe this same consistence among official households; there is no significant expenditure differential between affected and unaffected communes.

The result indicates that the affected and the unaffected communes share numerous characteristics. Still, we are cautious about the potential selection bias. For example, there could be unobserved characteristics of the affected communes that make it easier for corruption to take place. Likewise, there may be unobserved characteristics of populations in affected communes that cause them to settle there. As such, the empirical strategy is mostly focused on the combination of panel data and the exogenous aspect of the disaster. The fixed effect approach, which addresses time invariant elements of the communes and households, helps partially solve unobserved commune and household characteristics. In a sense, this study may be considered the second best alternative to an ideal natural experiment study^{xii}.

4. A Theoretical Framework

To guide the empirical study, we build upon the Becker and Stigler (1974) seminal paper to develop a simple model, so as to identify the determining factors of corruption. We rely on Becker's and Stigler's formulation because it is simple yet insightful, and has been supported by a number of empirical studies e.g., Di Tella and Schargrotsky (2003). We show that the greater the loss the disaster causes to the commune, the more local transparency is affected, and thus the higher the incentive for officials to become corrupt. Also, the income differential between officials and non-officials can explain the increase in corruption. A key insight is

that officials might not have the same level of incentive to corrupt if their wages are sufficiently higher than workers in other occupations. Thus, a small wage gap may be a causal factor of corruption. We sum up the key insights in the two following lemmas:

Lemma 1: The higher the loss caused by a natural disaster to the communes, the more the local official corrupts.

Lemma 2: The smaller the gap in wages between local officials and non-officials, the higher the incentive for corruption.

We relegate the detailed derivations of the model to Appendix 1.

Lemmas 1 and 2 highlight two of the primary reasons for the prevalence of corruption: the natural disaster, and the wage gap between official and nonofficial workers. The empirical section demonstrates that the former is more likely to affect the expenditure differential, and thus indirectly affect corruption.

5 Dataset

Our dataset is drawn from the 2002, 2004, 2006, and 2008 panel of the Vietnam Living Standard Survey (VLSS). The Vietnam's General Statistical Office - with technical assistance from the World Bank, and funding from the United Nations Development Program and the Swedish International Development Agency – conduct this survey biannually. The sample of the VLSS was a self-weighted sample drawn from Vietnam nationwide. The sample was stratified so that 20% of the households were from urban areas, thus corresponding to the rural/urban population ratio of Vietnam at that time. Within each of the two strata, the list of all communes (around 10,000 in total) was drawn up province by province. The communes were then selected in such a way that they were spread out evenly among all provinces in

Vietnam. Each month, the VLSS covered one tenth of the sample; the total fieldwork took about 12 months. The VLSS was implemented at the highest standards set out by the World Bank. Intensive supervision was implemented to ensure the reliability of the data: one supervisor for every two interviewers, one anthropometrist, and one data entry operator.

The VLSS covers two types of data: a household questionnaire and a community questionnaire. The former provides information about the characteristics of the households including income, expenditures and consumption; educational level of the household's members; health, fertility and nutrition; employment and earnings; migration activities; housing and durable assets; agricultural activities; non-agricultural self-employment; credit and savings; and general community characteristics. The latter includes detailed information about the commune. The questionnaire for communes is completed by local government officials, village chiefs, teachers (for the Education section), and public health workers (for the Health section).

We focus the analysis on rural households, which accounts for almost 80% of the observations. This is because rural households are distinctly more affected by disasters than those in urban, primarily due to their dependence on agricultural production.^{xiii} Also, formal institutions are more developed in urban areas, which help households cope with disasters much better than rural households. For obvious reasons, we also drop households whose answers were deemed unreliable by the interview team. In the analysis, we have 2984 communes and 27,050 households. An explanation of the variables can be found in the Appendix A2.

6. Empirical strategy and major findings

In a nutshell, this study indirectly explores the effect of a natural disaster on corruption. We first rely on the exogenous feature of the disaster to identify its effect on a household's

income and expenditures.^{xiv} We then examine whether the effect of natural disaster on income and expenditures share the same pattern. If the disaster affects the official households more favorably, it may point to evidence of corruption behavior among officials in the affected communes.

The key variable in this study is the occurrence of a natural disaster. The VNLSS surveys ask the following question in the commune’s questionnaire: “In the last three years, has your commune experienced any natural disaster?”. The interviewees were then asked to fill in the corresponding year in which the disaster occurred. We generate a binary variable to indicate whether the commune was hit by natural disasters - including droughts, earthquakes, epidemics, floods, extreme temperatures, insect infestations, avalanches, landslides, storms, volcanoes, fires, and hurricanes. The lag of the disaster variable is also used since it may arguably affect expenditure, income, and coping strategies. Another variable of interest is local officials. We define local officials as those working for one of the following local government organizations of the communes: the communist party organ, the committee council, and the police station.

Consumption income gap approach based specification

We first provide an overall pattern of the correlation between household’s expenditure and consumption. As Gorodnichenko et al., (2009) we build the empirical strategy upon the consumption-income gap approach. The key idea is related to the Permanent Income Hypothesis conjecturing that consumption signals important information about income. Consistent gap between consumption and income may suggest unreported income, and point to the existence of corruption. Following this insight, we consider the specification:

$$\ln\left(\frac{E_{itv}}{Y_{itv}}\right) = b_0 + b_1 * official + b * X_{itv} + d_v + t_g + C_{vt} + e_{itv} \quad (1)$$

where the index i, j, t represent individual i , commune v , and time t respectively

E_{itv} , Y_{itv} represent the household's per capita expenditure and income
 $official$ is the binary variable indicating whether the household has
at least one member to work for local government

X_{itv} is a vector of the household's demographic characteristics

C_{vt} is a vector of time-commune covariates

d_v, t_t are commune, and year fixed effect respectively

e_{itv} is the standard error term.

We run the above model for natural disaster affected and unaffected communes separately. Table 3 presents the main determinants of the household's expenditure-income gap. Most noticeably is the significant and positive effect of the "official" variable in the regression for affected communes. This result implies that the expenditure-income gap for official households in those communes is significantly greater than other households in the same communes. Put differently, controlling for income level - official households in affected commune are likely to spend more than nonofficial counterparts. In the following sections, we will show that this result may point to the evidence of corruption among local officials.

6.1. The effect of natural disasters on household income

We next address the relationship between a natural disaster and household income. To address the effect of the disaster on income, we consider the following model specification:^{xv}

$$\begin{aligned} \ln Y_{itv} = & \beta_0 + \beta_1 * D_{vt} + \beta_2 * official + \beta_3 * official * D_{vt} + \beta_4 * I_{vt} + \beta_5 * I_{vt} * official & (2) \\ & + \beta_6 * wgap_{vt} + \beta_7 * wgap_{vt} * D_{vt} + \beta_8 * wgap_{vt} * official + \beta_9 * wgap_{vt} * official * D_{vt} \\ & + \alpha_1 * D_{vt-1} + \alpha_2 * official * D_{vt-1} + \gamma C_{vt} + \lambda X_{itv} + \delta_v + \tau_t + \varepsilon_{itv} \end{aligned}$$

where Y_{itv} is the household's per capita income, D_{vt} is a binary variable representing whether the household was in the affected area, I_{vt} is a binary variable indicating whether the natural

disaster caused more than 10% reduction in the crop output, $wgap_{vt}$ represents the wage gap between officials and non-officials in commune v , c_{vt} is a vector of commune-time covariates, d_v and t_t represents the commune and time fixed effect, X_{ivt} is a vector of household's demographic characteristics.

Main Findings

Table 4 presents the result from the OLS model using the above specification. As expected, the natural disaster and its scale have a negative effect on the per capita income of households. Also, a natural disaster on a larger scale has a greater impact. Interestingly, we find that the interaction between the natural disaster and official b_3 does not have a significant effect on income. This finding implies that official households' incomes decrease as much as non-official households in affected communes.

6.2. Natural disasters, expenditures, and corruption analysis

We continue the analysis by examining the link between natural disasters and household expenditure. The last section's finding implies that the disaster affects official households as much as nonofficial ones. We are interested in whether that same effect still exists for the household expenditure. To address the link between disaster and household expenditure, we apply the same empirical specification (2) in which the dependent variable E_{ivt} is the household's per capita expenditure.

$$\begin{aligned} \ln E_{ivt} = & \lambda_0 + \lambda_1 * D_{vt} + \lambda_2 * official + \lambda_3 * official * D_{vt} + \lambda_4 * I_{vt} + \lambda_5 * I_{vt} * official & (3) \\ & + \lambda_6 * wgap_{vt} + \lambda_7 * wgap_{vt} * D_{vt} + \lambda_8 * wgap_{vt} * official + \lambda_9 * wgap_{vt} * official * D_{vt} \\ & + \alpha_1 * D_{vt-1} + \alpha_2 * official * D_{vt-1} + \gamma C_{vt} + \lambda X_{ivt} + \delta_v + \tau_t + \varepsilon_{ivt} \end{aligned}$$

To explore evidence for corruption, we proceed with the following strategy. The previous section has shown that the natural disaster reduces the income of official households as much as nonofficial households.^{xvi} We expect to observe the same story with the household's expenditure. If the expenditures of official households are less affected by the disaster, it evidences corruption by officials in the affected communes. Specifically, they may abuse relief aid and other related funds to compensate for loss in income. To incorporate Lemma 1 from the theoretical section, we consider the effect of the disaster scale and its interactions with official. Regarding Lemma 2, we are interested in whether communes whose officials have lower wages than other workers are more likely to experience corruption. In particular, we can look at the two following aspects: first, the interactive effect of the official and the wage gap variables, and second, the triple interactive effect of official, wage gap, and natural disaster variables – also known as the difference-in-difference-in-differences (DDD) estimation. Lemmas 1 and 2 in the theoretical model show that corruption may be increased due to 2 factors: a natural disaster, and a wage gap between official and nonofficial workers. Integrating this insight into model specification (3), we arrive at two corresponding scenarios:

1. Both λ_8 and λ_9 are significantly greater than zero. This implies that officials are more likely to corrupt in communes with a negative wage gap ($\lambda_8 > 0$). Also, the wage gap has a higher effect in affected communes ($\lambda_9 > 0$).
2. Only λ_9 is significantly greater than zero. As such, corruption – due to the wage gap – is likely to occur only in the affected communes. This scenario is consistent with lemma 1, which states that a more severe disaster leads to a higher level of corruption. It is also possible that officials in the affected communes have more windfall resources available, such as relief funds, to corrupt. Moreover, worsened transparency resulting from a natural disaster can increase the incentive for corruption.

Main findings:

The result from Table 5 shows that a natural disaster has a negative effect on the household's expenditure, as with income; though the effect is significant at only 10% level. Overall, official households enjoy higher expenditures than nonofficial ones. The most interesting finding is the significant effect of the interaction term between the disaster scale and the official β_5 suggesting that natural disasters significantly favor the official households' per capita expenditures. Likewise, the interaction between the disaster scale and the official β_7 is significant. This finding supports Lemma 1 because it suggests that a positive correlation between the disaster severity and corruption level.

Regarding the effect of the wage gap between officials and non-officials, we do not observe a significant interaction effect of official and the wage gap β_8 on expenditure. Yet, the triple interaction of official, the wage gap, and natural disasters β_9 does have a significant effect. This finding is consistent with scenario 2 mentioned above, and implies that the wage gap has a stronger effect on corruption in affected communes than unaffected communes. Furthermore, it points to the conjecture that natural disasters seem to be the primary driver of corruption, rather than the wage gap.

To see a clearer pattern of the differential effect that natural disasters have on official and nonofficial households, we run the regression for them separately. Table 5, columns 3 and 4 present the results for official and nonofficial households respectively. The key finding is that nonofficial households in the affected communes have significantly lower per capita expenditures than their counterparts in unaffected communes; the effect is even stronger in more severely affected communes. However, the pattern is very different for official households. Specifically, a natural disaster shows a significant effect at the 10% level, and its scale shows an insignificant effect on expenditure. The t statistics test indicates higher

coefficients of natural disaster and its scales for official households, thereby suggesting that natural disasters affect official households more favorably than nonofficial households. This poses the question: which factor derives this sharp differential?

We conjecture that the source of the above difference can be largely explained by the corruption by local officials in the affected communes. A natural disaster may increase the incentive to corrupt through two channels. First, natural disasters are usually accompanied by relief funds, or windfall resources. Therefore officials in affected communes may abuse their power and access the funds for personal use. Conversely, nonofficial and official workers in the unaffected areas do not have access to such funds. Secondly, disasters may disturb local governance making it more difficult to maintain transparency and accountability. This in turn makes it easier for officials to corrupt.

7. Coping mechanisms

The above analysis indicates an interesting link between natural disasters, household income, and household expenditures. We find indirect evidence of corruption by officials in affected communes. However, there remains an important aspect: it is quite plausible that official households in affected communes have better coping mechanisms than other households. For example, official households may have better access to formal financial institutions making it easier for them to smooth consumption in the wake of the disaster. If so, it is possible they will yield a better outcome than nonofficial households in the aftermath of natural disasters, even without corruption. While there are a number of coping mechanisms, we will focus on the most important ones: remittances and migration. We relegate other mechanisms in the Appendix. ^{xvii}

7.1. Remittances:

Both domestic and international remittances play a key role in stabilizing the household's consumption in the event of an unexpected shock, such as a natural disaster (Noy, 2007). It is worth asking whether official households receive more remittances than non-official households. If so, it's not corruption but rather corruption may explain higher expenditure among official households in the aftermath of a disaster. We present the main finding in column 1 of Table 6. All key interaction terms between officials and natural disasters are not significant. This finding implies indifference in the likelihood of receiving remittances between official and nonofficial households in the affected areas.

7.2. Migration

Migration plays an important role in coping with disaster. Households may choose to move to other communes in response to a natural disaster. Those choosing to remain in affected communes may possess unobservable characteristics. Put differently, there could be selection bias among households stationing in the affected communes.^{xviii} This bias could influence income and expenditure behaviors. In what follows, we will show that households in affected share much the same migration patterns as those in unaffected communes.

Our analysis is based on the VNLSS question asking how long the participants have been living in their current communes. We define migrant households to be those whose heads' age are greater than the number of years the household has been living in the commune^{xix}. We are interested in whether there are more migrant households in the unaffected communes. Another interesting question relates to the differences in migration behavior between official and nonofficial households.

Given the binary nature of the dependent variable – i.e., whether or not the household is a migrant household – we apply the same model specification as in section 7.4. Column 2 of Table 7 presents the relationship between migration and other variables. We do not observe

any significant difference between households in affected and unaffected communes. Interestingly, there are more migrant households in communes in which the wage gap between officials and non-officials is higher.

Conclusions:

This study explores the link between natural disasters and corruption. We find a natural disaster reduces household incomes for both official and unofficial households. Further, more severe disasters correlate with a greater decrease in household incomes. At the same time, natural disasters have almost no effect on expenditures per capita for official households in the affected communes, while they do have a significant effect on nonofficial households in the same communes. We conjecture that in response to the impact of natural disasters, officials may abuse their power for private gain. Furthermore, more severe disasters induce higher incentive for officials to corrupt.

Our paper can be improved upon in a number of aspects. First, though disasters may be exogenous at the commune level, they may not be so at the household level. For example, Buitenhuis (2006) and Mueller & Quisumbing (2011) find that poor households in Bangladesh are more sensitive to flood shock. While we have elaborated on this point at some degree in the section on coping mechanisms, it is important to fully explore whether poor households are more sensitive to natural disasters.^{xx} Secondly, an important channel through which a natural disaster increases corruption is via its effect on government transparency. As highlighted, the disaster may arguably affect local governance, making it more difficult to monitor the distribution of relief aid. Due to a lack of data, we have not explored this channel thoroughly enough. The link between natural disasters and governance points to a need for a more active role from the central government in monitoring local officials and relief aid in affected communes. The more severe the disaster, the higher the

incentive for corruption, and thus the greater the effort required by the central government to maintain transparency and accountability. Further research in this dimension could be promising in terms of providing more insight into corruption literature.

To some extent, we follow a “forensic economic” approach to identify evidence of corruption. An assumption here is that official and nonofficial households share the same coping mechanisms. Thanks to the rich and comprehensive data set, we are able to explore and demonstrate robust findings on various coping mechanisms that households may use. However, other unobserved coping mechanisms might exist. Likewise, dynamic effect of corruption on income and consumption is interesting yet unexplored in the literature. For instance, the household’s ability to smooth consumption may rely on assets purchased using past corruption. These are potential directions for future research to explore.

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Table 1: Summary statistics of communes

	Affected communes		Unaffected communes	
	Mean	Std. Dev	Mean	Std. Dev
Land area	38	12	35	15
Population	10149	6340	10187	7261
Average household size	4.40	1.01	4.68	1.30
Gini coefficient	0.32	0.12	0.31	0.10
Percentage of underdeveloped communes*	10	2.3	13	3.20
Commune's Proportion of farmers	0.81	0.32	0.85	0.23
Proportion in coastal region	8.39		7.02	
Proportion in delta region	60.33		51.40	
Proportion in highland region	8.36		5.30	
Proportion in mountain region	9.12		19.22	
Proportion in high mountain region	13.81		17.06	
Distance to district center (km)	4.80	1.23	4.50	1.15
Number of communes	1302		1682	

* Note: The underdeveloped communes are categorized by the central government, which implements various programs to help improve the socioeconomic conditions of the communes.

Table 2: Household's main characteristics

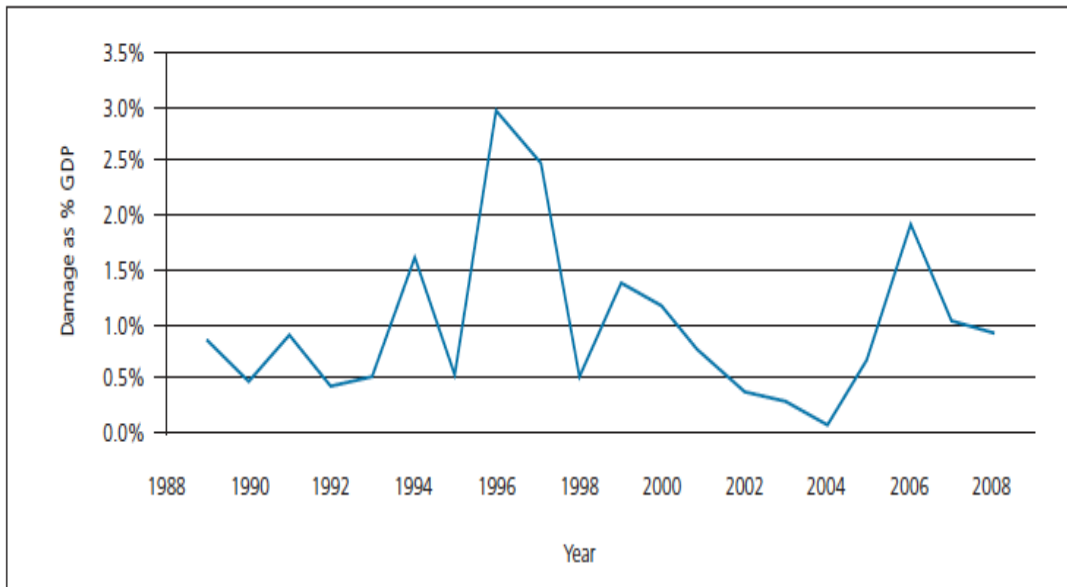
	Mean			Std.		
	N.official	Official	Total	Dev N.official	Official	Total
Total						
Age	32.81	31.53	32.7	21.22	18.73	21.04
Gender	1.48	1.49	1.48	0.5	0.5	0.5
Schooling years	6.39	9.64	6.65	3.61	3.06	3.68
Total hh consumption expenditure (1000VND)	33730	38898	35829	9580	5758	9319
Total hh main income (1000VND))	38234	38358	38391	5262	5945	5683
Remittance (1000VND)	39.86	47.68	42.14	16.86	21.14	18.72
Savings (1000VND)	1558	1778	1588	358	788	577
Access to banking (%)	25.23	28.18	26.15			
Migration (%)	5.25	3.28	4.58			
N	25770	1280	27050			
Unaffected						
Age	33.43	32.08	33.31	21.38	19.19	21.21
Gender	1.49	1.48	1.49	0.5	0.5	0.5
Schooling years	6.83	9.7	7.07	3.54	3	3.58
Total hh consumption expenditure (1000VND)	36694	38315	37905	3358	2842	3974
Total hh main income (1000VND)	41274	42584	42551	3970	3889	3932
Remittance (1000VND)	54.52	47.65	48.58	23.62	29.61	25.39
Savings (1000VND)	2378	2357	2358	323	567	458
Access to banking (%)	24.35	28.38	25.58			
Migration (%)	5.38	2.35	4.35			
N	14181	716	14897			
Affected						
Age	32.02	30.78	31.93	21.03	18.04	20.81
Gender	1.47	1.49	1.47	0.5	0.5	0.5
Schooling years	5.79	9.56	6.08	3.63	3.14	3.73
Total hh consumption expenditure (1000VND)	30255	31236	33165	3537	3346	3645
Total hh main income (1000VND)	35649	35877	35810	4464	5123	3256
Remittance (1000VND)	37.74	38.96	38.32	21.49	25.75	23.31
Savings (1000VND)	1335	1355	1338	458	857	758
Access to banking (%)	25.58	28.25	27.18			
Migration (%)	5.12	1.25	3.28			
N	11589	564	12153			

Table 3: Being an official has significant effect on household's expenditure and income in affected communes

	Affected communes	Unaffected communes
Number of HH members	-0.021 (0.012)	-0.015 (0.112)
Age	-0.026 (0.023)	-0.032 ** (0.015)
Gender	-0.012 (0.112)	-0.023 (0.018)
Log of schooling years	0.014 (0.015)	0.017 (0.012)
Official	0.025 ** (0.011)	0.005 (0.016)
Coastal region	-0.012 (0.133)	-0.015 (0.021)
Delta rivers regions	-0.011 (0.023)	-0.016 ** (0.008)
Highland region	-0.021 * (0.011)	-0.014 (0.025)
Control for other demographic variables	Yes	Yes
Year fixed effect	Yes	Yes
Commune fixed effect	Yes	Yes
Number of households	12153	14897
Adjusted R squared	0.05	0.06

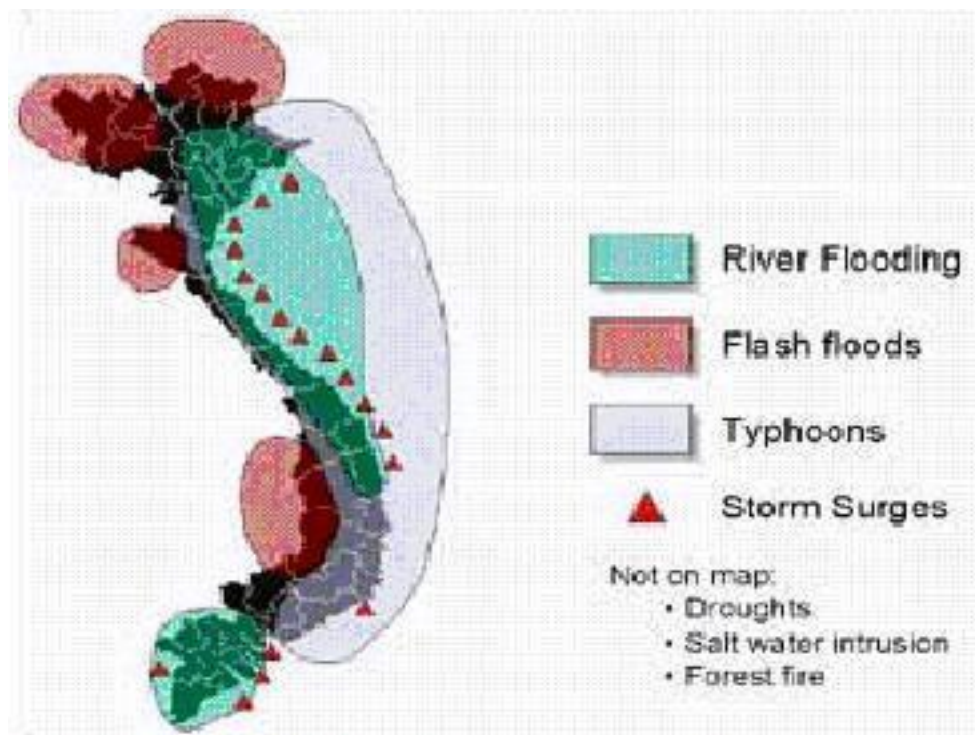
Robust standard errors clustered at communes in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 1.1. Value of Natural Disasters as Percentage of Gross Domestic Product (1998 to 2008)



Source: World Bank analysis of CCFSC damage data in VND.

Figure 1.2: Map of natural disaster in Vietnam



Source: Central Committee for Flood and Storm Control

ⁱ The quotation is found in the book “Arthaśāstra, The Science of Wealth” by Thomas R Trautmann.

ⁱⁱ Baker and Bloom (2015) show that the occurrence of a natural disaster may be endogenously given in the long run, for example deforestation may cause changes in the frequency of natural disasters. However, in the short run disasters are mostly exogenous. This relates to the discussion on global warming and rainfall – a widely used instrumental variable in many studies.

ⁱⁱⁱ As discussed in the literature review, most studies on corruption use information on the “corruption perception” as a proxy. Few other studies look at bribery amounts reported by individuals or firms; both have shortcomings. For instance, bribery reporting may be subject to errors given the illegality of corruption, both from the perspective of officials who receive the bribes, and from the individuals or firms who offer the bribes.

^{iv} We thank a referee for this insight.

^v Hence, the incentive effects of a one time windfall on officials may be very different from those related to steady state spending.

^{vi} The panel household living standard surveys used in this study contain very detailed information about the status of households, including income, expenditures, employment, education, investment, access to credit markets, and so on.

^{vii} Other channels may also exist. For example, Hunt (2007) using Peruvian data finds that victims of natural disasters are more likely to be involved in a bribery episode.

^{viii} In their study, the instances of corruption include only those discovered by the Department of Justice. Thus, they may likely underestimate the actual incidences.

^{ix} A commune is the smallest administrative unit in Vietnam. Each commune includes several

villages, which are the traditional form of communities in Vietnam.

^x Ferraz and Finan (2011) show that the practice of political institutions may affect corruption level at the local level in Brazil.

^{xi} Source: <http://gfdrr.org/ctrydrmmnotes/Vietnam.pdf>

^{xii} In an ideal natural experiment, that has a perfectly random assignment of affected (treatment group) and unaffected communes (control group), cross sectional data is sufficient for identification. As Angrist and Pischke (2009) mention this ideal natural experiment setting mentioned above is very rare.

^{xiii} Haughton and Khandor (2009) provide a good discussion on the measures of income and consumption for the case of household survey used in this study

^{xiv} The incomes used in the following analysis are total incomes from main economic activities, while expenditures refer to spending on consumption. The VNLSS provides detailed information on income and expenditure by category. Please refer to appendix A4 for a summary statistics. To check robustness, we also ran the regression for significant categories. For example, we may consider income from agricultural production and expenditure on consumption and so on. Findings from alternative specifications are consistent with those reported here.

^{xv} We can simplify the model by removing the lag terms. Actually, the empirical results don't find these terms to be significant.

^{xvi} Their disaster coping mechanisms are also insignificantly different, as demonstrated in the next section.

^{xvii} For all mechanisms, we apply the same model specification for income and expenditures as follows:

$$\begin{aligned} \ln R_{ivt} = & \beta_0 + \beta_1 * D_{vt} + \beta_2 * official + \beta_3 * official * D_{vt} + \beta_4 * I_{vt} + \beta_5 * I_{vt} * official & (4) \\ & + \beta_6 * wgap_{vt} + \beta_7 * wgap_{vt} * D_{vt} + \beta_8 * wgap_{vt} * official + \beta_9 * wgap_{vt} * official * D_{vt} \\ & + \alpha_1 * D_{vt-1} + \alpha_2 * official * D_{vt-1} + \gamma C_{vt} + \lambda X_{ivt} + \delta_v + \tau_t + \varepsilon_{it} \end{aligned}$$

where R_{ivt} represents the household's remittances, savings, and asset plus durable goods holding.

^{xviii} Yet, as mentioned in section 3.2, a natural disaster generates a highly random assignment between affected communes and unaffected communes; thus, we do not observe significant differences in observable characteristics between households.

^{xix} For simplicity, we do not consider multiple migrations in which the households return to their original commune after having moved to another commune for a certain period of time.

^{xx} Mueller & Quisumbing (2011) also show that agricultural workers who switched employment to the non-agricultural sector as a coping strategy may have benefitted in terms of having a lower per cent reduction in wages.