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How Big Are the Benefits of Economic Diversification? Evidence from Earthquakes

Rodney Ramcharan

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How Big Are the Benefits of Economic Diversification? Evidence from Earthquakes

Prepared by Rodney Ramcharan[1]

Authorized for distribution by Arvind Subramanian

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Abstract

Economic activity is risky. Returns across economic sectors can be highly variable, potentially causing costly adjustments to consumption. However, when returns are imperfectly correlated across sectors and insurance is unavailable, diversification can reduce the economic impact of shocks. Therefore, despite the well-known efficiency benefits from specialization, the risks of too little diversification have long been acknowledged. But how big are the benefits of diversification? This paper exploits the exogeneity and randomness of earthquakes to address this question. There is robust evidence that more specialized economies experience larger declines in consumption when earthquakes occur, and consistent with the insurance channel, the cost of specialization is smaller in more financially developed economies.

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Author(s) E-Mail Address: Rramcharan@imf.org

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I. Introduction

Economic activity is risky. However, when returns across economic sectors are imperfectly correlated and insurance is unavailable, diversification can reduce the economic impact of shocks. Therefore, despite the well-known efficiency benefits from specialization, the risks of too little diversification have long been acknowledged.[2] Indeed, several theories view the tradeoff between specialization and diversification in the presence of uninsurable shocks as a key determinant of economic development.[3] But how effective is diversification in mitigating the costs of shocks? Surprisingly, there is little systematic evidence quantifying the relationship between economic specialization and the cost of shocks. This paper uses the exogeneity and randomness of earthquakes to help estimate the impact of economic specialization on the cost of shocks.

Earthquakes are geophysical hazards that are usually precipitated by movements in the earth's tectonic plates.[4] The resulting surface level shaking can cause substantial damage to human and physical capital. And aside from the celebrated 1975 Haicheng Earthquake in China, where, based on abnormal animal behavior, an earthquake was correctly predicted sufficiently in advance to reduce casualties, earthquakes remain unpredictable events, commonly regarded as random shocks of mostly low probability.[5] The unpredictability of earthquakes, the idiosyncratic nature of the damage across sectors and the fact that their incidence is largely unrelated to human activity provide several advantages in identifying how specialization can influence the economic cost of shocks.

First, since earthquakes are not determined by the pattern of economic specialization, they can help identify the role of specialization in shaping the cost of shocks from the related but distinct role that specialization patterns play in determining shocks. For example, two economies may have the same degree of specialization, but in very different sectors, e.g. agriculture and manufacturing, and thus subject to different types and frequencies of shocks, making systematic cross-country inferences about the links between specialization and the costs of shocks difficult. Second, because the precise timing of earthquakes usually cannot be predicted accurately, the anticipation of a particular earthquake would not be expected to influence the degree of specialization. Of course, a country's general susceptibility to earthquakes may influence it's specialization patterns. Earthquake susceptibility, however, is usually determined using a broadly agreed upon set of country observables that can be included in the estimation framework.

[2] Brainard and Cooper (1968), Kemp and Livatan (1973).

[3] See for example Obstfeld (1994), Saint-Paul (1992), and Acemoglu and Zilibotti (1997).

[4] See Bolt (1999) for a recent survey of the literature on the causes of earthquakes.

[5] Indeed, 18 months later there was no formal prediction when an earthquake of a similar magnitude occurred in Tangshan, China, killing a quarter of a million people Fradkin (1999).

Third, earthquakes idiosyncratically affect economic sectors. While some sectors may be devastated, others may remain unaffected or may benefit. And predicting the impact across sectors is difficult, for in addition to the well-known damage to the building stock, earthquakes can also destroy transportation systems and pipelines, potentially impacting not only manufacturing but agriculture, fisheries, and other sectors (see Brookshire et al., 1997, for a discussion of the 1994 Kobe earthquake). For example, detailed case study evidence from the 1999 Turkish earthquake documents this heterogeneity, as employment immediately declined in agriculture, manufacturing, and construction but rose in services (World Bank, 2003). Therefore, by inducing imperfect correlation in returns across sectors, earthquakes can help identify the extent to which economic diversification affects the cost of shocks.

Using a panel of 39 countries over the period 1971-2002, the evidence suggests that the degree of intersectoral specialization greatly magnifies the consumption cost of earthquakes. A 1 standard deviation increase in specialization since the last earthquake is associated with an almost 2 percentage point additional decline in household expenditures in the year of the current earthquake. Stated differently, when an earthquake measuring 6.25 on the Richter scale—the median value in the sample—occurs, there is a small increase in the change in household expenditures of about 0.05 percent of GDP for an economy at the median level of specialization. In contrast, an identical shock in an economy at the 90th percentile of specialization is associated with -0.75 percent of GDP decline in the change in household expenditures. These results are robust across a variety of specifications. However, they are less robust when using specialization measures derived solely within the manufacturing sector, suggesting that diversification across economic sectors rather than intrasectorally may have significant implications for the economic cost of shocks.

Building on the idea that intersectoral diversification shapes the cost of shocks, the analysis indicates that the impact of specialization is closely related to the level of financial depth. For an economy at the median level of financial depth—proxied using the ratio of broad money to GDP—a 1 standard deviation increase in specialization is associated with a 0.45 percentage point worsening of the impact on household expenditures in the year of an earthquake. A similar increase in specialization for an economy at the 10th percentile level of financial development is associated with a 3.29 percentage point decline in household expenditures. This evidence is consistent with the idea that the greater availability of financial instruments can help agents smooth consumption when adverse shocks occur, partially mitigating the risks associated with a lack of diversification.

This paper is related to the empirical literature that examines the causes and consequences of economic specialization (Kalemli-Ozcan et al., 2004, 2001; and Imbs and Wacziarg, 2003). And the results have implications for the previously cited theories that explore the link between development and diversification. The paper is less directly related to the substantial literature on international risk sharing (Bekaert, 2004, and Van Wincoop, 1999), and of course, the larger literature that uses weather events as part of an identification strategy (see, for example, Brunner, 2002; Miguel et al., 2004; and Paxson, 1992) and the survey by Rosenzewig and Wolpin (2001). The paper is organized as follows. Section II provides an overview of the data and discusses both the incidence and economic impact of earthquakes. Section III reports the empirical results, and Section IV concludes.

II. DATA

This section documents both the incidence and the economic impact of earthquakes and briefly provides an overview of data and sources—more detail is provided in Table 1.

A. Overview of the Data

The data on earthquakes are taken from the Center for the Research on the Epidemiology of Disasters (CRED), with global coverage from 1900-2003. This database records an earthquake event based on the following conditions: 10 or more reported killed; 100 people reported affected; a call for international assistance; a declaration of a state of emergency. These relatively low thresholds ensure that most earthquakes are recorded in the database. Other data sources include the World Bank (WB), the International Labor Office (ILO, 2003), and the United Nations Industrial Development Organization (UNIDO, 2003). Coverage varies across the three databases, and the most common specification relies on a panel of 39 countries from 1971-2001.

The analyses use the International Labor Office (ILO, 2003) data on employment shares across sectors, covering all economic activities at the one-digit International Standard Industrial Classification (ISIC) level[6] as the principal source of cross-sector specialization. With little reason to emphasize a particular distribution measure, the analyses use four common measures: the Gini coefficient, the log mean deviation, the coefficient of variation and the Theil index. In addition, we also construct dispersion measures derived from the UNIDO (UNIDO, 2003). This data source has the benefit of finer detail since it covers the distribution of economic activity at the three-digit ISIC code. However, coverage is limited solely to the manufacturing sector, making it a less appealing measure of cross-sector diversification. And Table 2 indicates that the two UNIDO specialization measures (Gini) are more highly correlated among themselves than with the broader ILO derived specialization measure.

B. Incidence and Impact of Earthquakes

This section documents the incidence of earthquakes and their impact on consumption. As Table 3 indicates, there were 272 earthquakes for the 39 countries in the sample over the period 1971-2001. Geology and geography make some countries more earthquake-prone than others, and Table 3 also lists the frequency of earthquakes over this period, with China, Turkey, and the Islamic Republic of Iran most frequently subject to earthquakes. Intuitively, Table 4 reveals a large positive correlation between the probability of an earthquake and a country's size, as countries with larger surface area are more likely to have tectonic fault lines—a major cause of earthquakes—within their borders.

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[6] Using employment shares as a measure of sectoral concentration is common in the literature. See Imbs and Wacziarg (2003), Krugman, (1991), and Sukkoo Kim (1995) for examples.

Table 5 details the impact of earthquakes on consumption levels using two widely available measures: household final expenditures (*HCN*) and final consumption expenditures (*CON*). The latter measure includes government consumption expenditures. Because of differences in the definition of consumption across time and countries, we use both *HCN* and *CON* in the analysis,[7] scaled by GDP. In the pooled sample the mean level of *CON* in years with earthquakes is about 3 percentage points (p-value = 0.00) below the mean level for nonearthquake years; there is little difference in the standard deviation of *CON* across years compared with those years without earthquakes; a nonparametric rank sum test rejects the hypothesis (p-value = 0.00) that *CON* in earthquake versus nonearthquake years is drawn from the same distribution.

In the case of household expenditures (*HCN*), the mean level in earthquake years is about a percentage point less than those years without earthquakes (p-value = 0.05), and there is a marginally significant difference in volatility across earthquake years (p-value = 0.08). The negative impact of earthquakes observed in the aggregate consumption data is consistent with the micro-level evidence. Household surveys conducted after the 1999 Turkish earthquake revealed that nearly three-quarters of rural households reported a reduction in food consumption, and 26 percent reported an end to spending on nonfood consumption; 59 percent of urban households indicated that they cut down on nonfood items, while 15 percent claimed to have eliminated spending on nonfood items (World Bank, 2003).

III. Empirical Framework and Results

It is well established theoretically that when risks are uninsurable, economic diversification across sectors whose returns are imperfectly correlated can mitigate the impact of shocks. Thus, our rendition of this idea is quite minimal and is focused mainly on motivating the role of earthquakes in the empirics. To this end, we assume that there are two sectors, *A* and *B,* that produce an identical good, labor is the sole input, and wages are w^A and w^B respectively. We assume that $w^A > w^B$, so that without uninsurable risks, production would be specialized in sector A. However, an earthquake occurs with probability p and to easily capture the idea of imperfectly correlated sectoral returns across states of nature, we assume earthquakes shut down production in sector A, $w^A = 0$, while sector B remains unaffected. Because of the idiosyncratic risk, the optimal fraction of labor in sector A, λ, reflects the tradeoff between the gains from specialization in that sector versus the benefits of diversifying income in the less risky sector B. And in the case of log utility, the fraction of labor in sector *A* that equalizes marginal consumption across the two states is:

[7] For many countries consumption is calculated as a residual in the national accounts. And in some cases firm consumption, as well as errors and omissions, is included in household consumption. Therefore, we use both measures of consumption to gauge the robustness of these results.

$$\lambda = \left[w^A (1-p) - w^B \right] \left[\left(w^A - w^B \right) \right]^{-1} \tag{1}$$

Equation (1) makes it clear that the sectoral allocation of labor can shape the impact of an adverse uninsured shock on consumption; $-\lambda w^A$ is the difference in consumption between earthquake and nonearthquake states.

A. Direct Impact Measures

Turning to the data we investigate how the preexisting variation in specialization can affect the consumption cost of earthquakes. We first consider the most intuitive and direct measure of impact, leaving more general specifications for the section on robustness. In particular, for country *i* we consider the subsample of years with earthquakes, letting y_{it} denote the impact of an earthquake on country *i*'s consumption in year *t.* The impact on consumption is defined as the simple difference between consumption in the year of an earthquake and the last nonearthquake year. To understand the role of preexisting country characteristics, X_{it-1}, and the degree of specialization, SPC_{it-1}, in determining the consumption impact across earthquakes in country *i*, we use their values in the year before the earthquake in period *t*.[8] The estimating equation is thus:

$$y_{it} = \beta_0 + \beta_1 SPC_{it-1} + X_{it-1}\beta_2 + p_i(c_i) + c_i + u_{it} + \varepsilon_t, \tag{2}$$

where β_2 is a vector of parameters to be estimated; c_i are country-specific time invariant factors such as endowment, geology, topography, size that determine the magnitude and probability of earthquakes, $p_i(c_i)$; u_{it} is a residual term that is allowed to be correlated across years for the same country in all regressions; and ε_t are time effects.

A key challenge to consistent estimation is that geography, endowment and other country-specific time invariant factors,[9] c_i , influence the probability of earthquakes, $p_i(c_i)$, specialization patterns, and the consumption cost of earthquakes, rendering it likely that SPC_{it-1}, and c_i , $p_i(c_i)$ are correlated. Intuitively, from equation (1) the optimal degree of diversification would be slight in countries where $p_i(c_i)$ is small, but those countries would suffer large consumption costs, $-\lambda w^A$, when earthquakes occur.

In addition to affecting the probability of an earthquake, geophysical characteristics such as topography and endowment can also directly affect both specialization patterns and the

[8] Variables observed in the same year may reflect the effects of the of the shock, rather than the variables' impact on the economic cost of the shock. See section on robustness.

[9] Movements in tectonic plates—the principal factor behind earthquakes—occur over hundreds of thousands of years, making it plausible to treat a country's geological characteristics as constant over the past three decades.

consumption cost of earthquakes. For example, mountainous countries with large transportation costs between regions may not become highly specialized. But high transportation costs may make it difficult to provide relief when earthquakes occur, magnifying the decline in consumption relative to the last nonearthquake year. Thus, because c_i can both directly and indirectly, via p_i (c_i), influence specialization patterns and the cost of shocks, the analyses emphasize the within-country variation in the data to mitigate these sources of country-specific omitted variable bias.

Before estimating equation (2), Figures 1-2 depict the bivariate relationship in the pooled sample between the Gini measure of specialization in the year before an earthquake, and the impact of earthquakes on the two consumption measures: household final expenditures (ΔHCN) and total final expenditures on consumption (ΔCON). Note again that impact is defined as the simple difference in consumption levels between the earthquake and last nonearthquake year. These figures anticipate the results: in both cases the consumption impact is worse in economies with greater preexisting intersectoral specialization. The nonparametric tests (Table 6) of independence between specialization measures in the year before an earthquake and the subsequent consumption impact are rejected in six out of the eight cases at the one percent level; the remaining two cases are rejected at the five percent level.

Using the within-country variation in the data column 3 of Table 7 documents the relationship between the Gini measure of labor specialization and the impact of earthquakes on household final expenditures (ΔHCN). Consistent with Figure 1, the point estimate is negative, but it's magnitude is about 2.5 times larger than the corresponding ordinary least squares estimate (column 2), though it is less precisely estimated (p-value = 0.07*)*. While these results summarize general tendencies within the data, the Venezuelan case is illustrative. An earthquake of magnitude 5.0 in 1980 saw a small increase in household expenditures of about 0.6 percent of GDP compared with the level in 1979. A second earthquake of similar magnitude—5.4—occurred in 1989, but *HCN* declined by 3.75 percent of GDP relative to the previous year; in the period between earthquakes Venezuela underwent roughly a 1 standard deviation increase in specialization. The point estimate in column 3 suggests that the increase in specialization over the period accounted for about 42 percent, or 1.9 percentage point, of the 4.55 percentage point difference in impact across the two events.

Column 4 includes the set of control variables—observed the year before the earthquake—that are potentially correlated with economic specialization and are likely to determine the consumption impact of earthquakes. Insurance opportunities in more developed countries, proxied for by GDP per capita ($GPC_{it\text{-}1}$), may be more widely available, and governments in those economies may be able to respond more effectively once earthquakes occur. At the same time, specialization patterns have been shown to be closely related to income levels (Imbs and Wacziarg, 2003). Some theories (Krugman, 1991) also predict that specialization patterns may be linked to population density ($\mathrm{PDN}_{it\text{-}1}$) and population size ($LPO_{it\text{-}1}$), but these variables are also likely to influence the consumption cost of earthquakes, although the direction of their impact is uncertain.

Earthquakes that strike densely populated countries may cause more damage, leading to larger declines in consumption. But population centers may evolve in those areas least subject to earthquakes, minimizing the impact of earthquakes.[10] Population density is also an imperfect proxy for the spatial agglomeration of economic activity—a factor that is likely to be closely related to specialization and the impact of earthquakes on consumption. Including per capita income, the log of population levels and population density does little to change the *SPC* point estimate. The point estimates of the control variables are intuitive. Higher-income countries experience smaller declines in consumption. Compared with the impact on ΔHCN in the previous earthquake, 1 standard deviation increase in per capita income is associated with a 1.7 percentage point increase in ΔHCN ; likewise, population density[11] enters negatively into the specification, consistent with the idea that the consumption impact is higher as economies become more agglomerated; that said, these additional covariates are not significant at conventional levels.

Columns 5-7 include the alternative specialization measures: the mean log deviation (column 5); Theil index (column 6); and the coefficient of variation (column 7). These estimates are uniformly negative, large and significant. Moreover, the implied impact is similar across all four measures. A 1 standard deviation increase in the mean log deviation since the last earthquake is associated with an additional 1.72 percentage point decline in ΔHCN in the year of the current earthquake. Similar increases in the Theil index and the coefficient of variation are associated with 2.14 and 2.37 percentage point declines in ΔHCN respectively. And as with the Gini specification, the control variables remain insignificant.

Table 8 repeats the above exercise using the simple difference in final consumption expenditures (ΔCON_{it}) between earthquake and last nonearthquake years as the dependant variable. Column 3 reports a negative association between the Gini measure of labor specialization and ΔCO_{it}: a1 standard deviation increase in $SPC_{it\text{-}1}$ implies a 1.6 percentage point decline in ΔCON_{it}. In the full specification (column 4), there is little change in the $SPC_{it\text{-}1}$ point estimate, but it remains insignificant at conventional levels (p-value = 0.12). columns 5-7 consider the alternative measures. These point estimates are uniformly negative, and the implied impact is similar across specialization measures, but somewhat smaller than those obtained using household expenditures (Table 7), reflecting that final consumption expenditures include government consumption, which would be expected to evince some countercyclicality. A 1 standard deviation increases in the mean log deviation, the Theil

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[10] That said, a cursory look at the population densities of Los Angeles, San Francisco, Tokyo, and other earthquake-prone zones would suggest little attempt to move away from these areas.

[11] Measuring the spatial distribution of population can be difficult. In cases where much of the land area may be uninhabitable, population density may be quite low, yet—as in the case of Australia—population centers may be quite dense. Thus, the analysis also included urbanization measures, but the results were little changed.

index, and the coefficient of variation are associated with 1.54 (p-value = 0.00), 1.72 (p-value = 0.09) and 1.85 (p-value = 0.15), percentage point declines in ΔCON_{it} , respectively.

B. Financial Depth

The theoretical tradeoff between diversification and specialization hinges on the inability of agents to insure against shocks. Therefore, if the estimated negative impact of specialization on the consumption impact of earthquakes reflects this theoretical tradeoff, then in instances where financial instruments are widely available, the impact of specialization would be smaller, since agents would be able to use those instruments to smooth consumption. Financial depth can also directly influence the degree of specialization. For example, the scarcity of credit may prevent agents from investing in new sectors, leading to a concentration of economic activity.

This subsection uses the ratio of broad money to GDP (*BMG)*—a widely available albeit imperfect proxy of financial depth[12]—to examine whether the negative impact of specialization on the cost of earthquakes is indeed moderated by the level of financial depth. To this end, the specification interacts *BMG* with the various measures of specialization (*SPC*). In addition, the specification allows *BMG* to enter into the specification linearly in order to control for possible omitted variable bias. These results are presented in Tables 9a and 9b, where because of the limited availability of *BMG* a smaller sample than Tables 7 and 8 is used. For comparison, estimates are also presented from the specification in Tables 7 and 8 using this smaller sample.

Using the impact on household expenditures as the dependant variable, the various specialization measures' point estimates in this truncated sample (Table 9a) are almost identical to those derived earlier (Table 7). Including the ratio of broad money to GDP (*BMG)* induces a qualitatively similar pattern across all four specialization measures: their point estimates become substantially larger and more precisely estimated; the interaction terms are consistently positive; and *BMG* enters with a negative sign, though it is not significantly different from zero.[13]

[12] See for example the survey by Levine (2004) for a discussion of the various proxies of financial development.

[13] To assess the robustness of the interaction term approach, we separate specifications as in Tables 7 and 8 were also run for those cases below and above the median level of *BMG*. While the estimates were usually less precise because of the smaller sample size, the absolute value of the specialization point estimates were uniformly larger in those economies below the median *BMG.* For brevity, these tables are not included in this paper but are available on request.

For example, the coefficient of variation measure is similar across the two samples (Table 7 column 7 and Table 9a), but the inclusion of BMG nearly doubles the magnitude of the point estimate, and it is now significant at the 1 percent level. Moreover, the interaction term is also significant, implying that the negative impact of specialization is more muted in economies with greater financial depth. For an economy at the median level of BMG_{it-1}, a 1 standard deviation increase in the coefficient of variation measure of specialization is associated with an additional 0.45 percentage point decline in the annual change in household expenditures compared with the decline observed in the last earthquake event. An identical increase in specialization for an economy at the 10th percentile of BMG_{it-1} is associated with a 3.29 percentage point decrease in the change in household expenditures.

A similar pattern emerges in Table 9b, where the dependent variable is the impact on final consumption expenditures. The specialization point estimates are analogous to those derived in Table 8, but they increase considerably in magnitude and precision once the financial depth proxy is included. In addition, the implied impact of specialization on ΔCON is similar across specialization measures, but somewhat less than ΔHCN in Table 9a. These results are consistent with the idea that the tradeoff between specialization and diversification is likely to be more profound when insurance opportunities are unavailable.

C. Robustness

This section uses a variety of approaches to assess the robustness of these results. First, we address timing. Variables observed in the year of the earthquake might reflect the effects of the shock rather than the role of preexisting characteristics in shaping the cost of earthquakes. That is, an earthquake that disrupts agriculture may force labor to migrate into the manufacturing sector, and lead both to increased specialization in the year of the shock and to a decline in consumption. While this traces the mechanism of the shock, it is different from investigating whether the consumption cost of the shock was larger because of the existing high degree of specialization in agriculture before the shock.

To understand better the mechanism of the shock, as well as to determine the sensitivity of the results to the timing of the regressors, Tables 10a and 10b reconsider the specification in Tables 7 and 8, using regressors observed in the same year as the earthquake. The estimated impact of specialization on the consumption cost of earthquakes is on average about 40 percent larger than those obtained when using measures recorded the year prior to the event (Tables 7 and 8). The larger estimates in Tables 10a and 10b suggest, perhaps not surprisingly, that the dislocation and idling of labor, which would generate increased labor concentration, are associated with larger declines in consumption. For example, the case study evidence after the 1999 Turkish earthquake (World Bank, 2003) indicated that the log mean deviation of labor allocation increased by 5 percent, as labor increased in the services but declined in other sectors.

Second, in addition to economic and geographical factors, the quality and nature of political institutions may also influence the relationship between the cost of earthquakes and economic specialization. In particular, the response of governments to earthquakes in nondemocracies may differ from that of democratic governments (Sen, 1999). And omitting these measures may be an important source of bias. To this end, we include the Polity IV index of democracy in the specification (Tables 11a and 11b). The point estimate is positive, indicating that democracies tend to incur smaller declines in consumption, but it is not significant. The specialization point estimates remain significant and only slightly smaller than the earlier estimates. As a further check, instead of democracy, we included an index that measures executive accountability. There is again little change in the specialization point estimates. Trade openness is another potential channel through which economic specialization might affect the cost of shocks. Several theories predict a positive relationship between trade and specialization, and more open economies may respond differently to real shocks. However, including the commonly used measure of trade openness—the ratio of imports and exports to GDP—as a regressor (Table 12) does little to alter the specialization point estimates.

Third, the analysis used the simple difference in consumption between the earthquake and last nonearthquake year to measure the impact of an earthquake. However, while earthquakes are random events, and consumption in the previous nonearthquake year is a useful benchmark, this approach can still prove misleading. To gauge the robustness of this approach, the analysis replicates the specification in equation (2) using the difference in consumption in the year of the earthquake versus its average value in all nonearthquake years—a reasonable proxy for consumption in the absence of earthquakes. By definition the average consumption level in nonearthquake years over the sample period is fixed for a given country, and we estimate equation (2) using OLS, treating these point estimates as a lower bound since OLS typically underestimates the specialization point estimate compared with country fixed effects. The results (Tables 13a and 13b) are consistent with those obtained earlier: specialization is negatively and significantly associated with this alternative measure of impact.

Fourth, a more general criticism is that the results in Tables 7 and 8 may not be limited to earthquake years, but may reflect a systematic pattern between specialization and changes in consumption that holds true for all years, including nonearthquake years. In that case, using earthquakes to identify the impact of specialization on the consumption cost of shocks would be invalid. As a first step, Table 14 replicates the nonparametric independence tests reported earlier in Table 6. Unlike Table 6, the hypothesis that the previous year's specialization pattern and the current change in consumption are independent series is not rejected in five out of the eight cases; the remaining three cases reject this hypothesis only at the 10 percent level. Using the same specification and sample of countries as in Tables 7 and 8, Tables 15a and 15b examine the relationship between specialization and the change in consumption in nonearthquake years.

The estimates in Tables 15a and 15b indicate no statistically significant relationship between any of the specialization measures and the two measures of consumption in nonearthquake years. Moreover, the point estimates are sometimes positive and much smaller in magnitude than those estimated in earthquake years, and the hypothesis that the point estimates are identical across earthquake and nonearthquake years is rejected. For example, from Table 15a, a 1 standard deviation increase in the Gini measure of specialization (p-value = 0.32) implies a 0.32 percentage point decline in the household expenditures; recall that the estimated relationship in earthquake years is about six times as large (Table 7). In addition to nonearthquake years, Tables 16a and 16b consider the specification for those countries that have experienced an earthquake in the past 100 years. Again, the point estimates are substantially smaller than earthquake years, and not significant.

Fifth, earthquake severity may be an important omitted variable. For example, the consumption cost of an earthquake with a large Richter scale measure is likely to be different from a less severe earthquake. At the same time, an economy prone to severe earthquakes may also have different specialization patterns. Thus, Tables 17a and 17b replicate the specification in Tables 7 and 8, including the Richter (*MAG)* scale measure of earthquake intensity—available for a subset observations. For comparison purposes, the estimates excluding *MAG* are reported for the smaller sample. The results remain robust: the magnitude of the specialization coefficients are uniformly larger and more precisely estimated when *MAG* is included.

Finally, Tables 18a and 18b pool the sequential approach. Instead of restricting the analysis to a subsample of years and countries, let $\tilde{y}_{it}$ denote the annual change in consumption for country *i* in year *t* for the full sample of countries and years for which data exist. Let $\widetilde{MAG}_{it}$ equal 0 in those years without earthquakes in country *i*, and the Richter scale measure of the earthquake's intensity in years with earthquakes in country *i*. The coefficient α_3 measures whether the impact of an earthquake on the change in consumption depends on the level of specialization in period $t-1$:

$$\tilde{y}_{it} = \alpha_0 + \alpha_1 \widetilde{MAG}_{it} + \alpha_2 SPC_{it-1} + \alpha_3 \widetilde{MAG} * SPC_{it-1} + X_{it-1}\alpha + v_i + u_{it} + \varepsilon_t \qquad (3)$$

And X_{it-1} , the set of control variables, includes per capita income, population density, total population, trade as a percent of GDP, the democracy index, as well as the percent of value added derived from agriculture to further control for country heterogeneity; v_i , ε_t , and u_{it} are standard time-invariant and time-varying unobservables.

Consistent with the previous results, Tables 18a and 18b indicate that the impact of earthquakes on the change in consumption is significantly larger in more specialized economies. In Table 18a, for example, α_3 is significant in three cases and is only marginally insignificant (p-valued = 0.14) when using the Gini measure. The estimated impact of specialization is also economically large. Column 3 of Table 18a implies that when an earthquake measuring 6.25 on the Richter scale—the median value in the sample—occurs, there is a small increase in the change in household expenditures of about 0.05 percent of GDP for an economy at the median level of specialization. In contrast, an identical shock in an economy at the 90th percentile of specialization is associated with a -0.75 percent of GDP decline in the change in household expenditures.[14]

[14] Measuring consumption in growth rates instead of first differences yield similar results. An earthquake measuring 6.25 on the Richter scale is associated with a 0.15 percentage point increase in consumption growth in an economy at the median level of specialization, but a -1.16 percentage point decline in an economy at the 90th percentile of specialization (p-value = 0.02). For brevity, these results are omitted but are available on request.

Dividing the sample into those observations above and below the median level of financial depth—the ratio of broad money to GDP—suggests that the negative impact of specialization is much more pronounced in less financially developed economies. For example column 3 of Table 18a indicate that the estimate of α_3 is negative and significant in those cases below the median level of financial development, but positive and not different from zero in those economies above the median level of financial depth. This asymmetry is replicated using other measures of inequality, but the estimates are less precise.

Does the negative relationship between cross-sector specialization and the cost of earthquakes extend to specialization within the manufacturing sectors? Tables 19-21 (available on request) estimate equation (3) using measures of specialization only within the manufacturing sector at the three-digit ISIC code based on the distribution of labor and the distribution of value added (UNIDO, 2003). Compared with the ILO data, the UNIDO data covers both more years and countries. However, while α_3 is uniformly negative in both the entire sample as well as across various subsamples, it is never significant. Thus, results appear to be robust to only cross sector measures of diversification rather than within a particular sector.

IV. Discussion

Exploiting the exogeneity and unpredictability of earthquakes, this paper has estimated the relationship between specialization and the cost of such shocks. Across various specifications the evidence consistently suggests that economic specialization can magnify the adverse impact of earthquakes on consumption. But the negative impact of specialization appears less pronounced in economies with greater financial depth, suggesting that the benefits of diversification are larger when insurance is unavailable.

Therefore, a potentially large tradeoff exists between the efficiency gains from specialization and the risks from too little diversification in economies with limited insurance opportunities. These results lend support to theoretical approaches that view this tradeoff as important for the development process. Economies subject to uninsurable risky production possibilities may optimally diversify, at the cost of lower productivity. Indeed, these results also raise questions about the long-run impact of earthquakes and other natural shocks on economic development, and suggest an interesting area of future research. For example, do countries subject to natural shocks experience different development patterns than those in more stable environments? That said, while using earthquakes as shocks greatly simplifies the estimation strategy, the generalizability of these results to more common economic shocks remains an area for future research. Would using the terms of trade or interest rates as a source of shocks reveal similar benefits to economic diversification?

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Table 1. Variables: Definitions and Sources

Variable	Definition	Source
AVL	Agriculture, Value Added (percent of GDP)	World Bank (2003).
BMG	Money and Quasi Money (percent of GDP)	World Bank (2003).
DEM	Democracy Score: general openness of political institutions	Polity IV, (2004).
CEX	Executive Constraints: operational (de facto) independence of chief executive.	Polity IV, (2004).
CON	Final Consumption Expenditures, (percent of GDP); Includes Government Consumption	World Bank (2003).
GPC	Ratio of Real GDP in $US to Population	World Bank (2003).
HCN	Household Final Expenditures, (percent of GDP)	World Bank (2003).
LPO	Log of Population	World Bank (2003).
MAG	Richter Scale Measure of Earthquake Intensity	CRED, (2003)
PDN	Population Density: People per Square Kilometer.	World Bank (2003).
TRA	Imports plus Exports Divided By GDP	World Bank (2003).

Table 2. Correlation Among Selected Specialization Measures

	Gini (ILO)	Gini (UNIDO(EP))	Gini (UNIDO (VA))
Gini (ILO)	1.0000		
Gini (UNIDO(EP))	0.3369	1.0000	
Gini (UNIDO (VA))	0.1450	0.6439	1.0000

Note: ILO: Labor allocation data from International Labor Office (2003); UNIDO (EP): Employment data (Manufacturing Only) from UNIDO (2003) ; UNIDO (VA): Value added data (Manufacturing Only) from UNIDO (2003);

Table 3. Countries in Sample and Average Incidence of Earthquakes, 1971-2001

Country	Percent of Years with Reported Earthquakes	Country	Percent of Years with Reported Earthquakes
Australia	4.8	Iran, I.R. of	37.5
Azerbaijan	2.8	Iceland	1.9
Belgium	1.9	Italy	19.2
Bangladesh	4.8	Japan	27.8
Bulgaria	3.8	Kyrgyz Republic	1.9
Bolivia	2.8	Mexico	18.2
Brazil	0.9	Nicaragua	7.6
Chile	19.2	Netherlands	0.9
China,P.R.: Mainland	38.4	New Zealand	4.8
Colombia	14.4	Pakistan	13.4
Costa Rica	5.7	Peru	26.9
Cyprus	1.9	Philippines	17.3
Germany	0.96	Russia	3.8
Ecuador	12.5	El Salvador	5.7
Egypt	4.8	Slovenia	0.9
Spain	1.9	Trinidad and Tobago	0.9
United Kingdom	0.9	Turkey	36.5
Greece	23.0	United States	25.9
Honduras	2.8	Venezuela, Rep. Bol.	6.7
Indonesia	32.6		

Source: Center for Research on the Epidemiology of Disasters (CRED, 2003).

Table 4. The Correlation Between Selected Economic Characteristics and the Frequency of Earthquakes

	Frequency of Earthquakes	GDP per capita	Population	Size	Population Density
Frequency of Earthquakes	1.000				
GDP per capita	0.225	1.000			
Population	-0.135	0.012	1.000		
Size	0.4744	0.5728	-0.0732	1.0000	
Population Density	-0.1480	-0.2479	0.2301	0.0425	1.0000

Table 5. The Impact of Earthquakes on Consumption Levels

	Final Consumption Expenditures (Percent of GDP)		Household Final Expenditures (Percent of GDP)	
	Mean	Standard Deviation	Mean	Standard Deviation
Earthquake Year	77.07	8.49	63.74	9.27
Non-Earthquake Year	80.03	8.86	64.86	9.94
Earthquake Year=Non-Earthquake Year (p-value)	0.00	0.40	0.10	0.15
Earthquake Year>Non-Earthquake Year (p-value)	1.00	0.19	0.95	0.92
Earthquake Year<Non-Earthquake Year (p-value)	0.00	0.81	0.05	0.08
Rank Sum Test (p-value)	0.001	--	0.34	--

Table 6. Earthquake Years : Chi-Squared Tests for Independence:
Labor Specialization (ILO, 2003) and the Impact of Earthquakes on Household Final Expenditures (ΔHCN) and Final Consumption Expenditures (ΔCON) 1971-2001

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
ΔHCN	0.000	0.035	0.000	0.000
ΔCON	0.000	0.026	0.000	0.000

P-values in rows indicate the probability of rejecting the null hypothesis of independence.

Table 7. Labor Specialization (ILO, 2003) and the Impact of Earthquakes on Household Final Expenditures, 1971-2001
Dependant Variable: Change in Household Consumption (ΔHCN)

	Gini	Gini	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)	(6)	(7)
SPC_{it-1}	-9.475** (5.204)	-20.219* (11.874)	-20.462* (11.511)	-5.123*** (1.523)	-11.289** (5.252)	-6.794* (3.670)
GPC_{it-1}	--	--	0.154 (0.395)	0.256 (0.360)	0.211 (0.371)	0.227 (0.362)
LPO_{it-1}	--	--	7.836 (16.002)	11.207 (15.927)	8.876 (15.583)	8.231 (15.596)
PDN_{it-1}	--	--	-0.018 (0.069)	-0.005 (0.065)	-0.023 (0.065)	-0.029 (0.062)
Year Dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects?	No	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.13	0.09	0.073	0.11	0.10	0.116
NOB	178	178	178	178	178	178

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. SPC_{it-1} indicates the specialization measure used in the specification; for example columns 4 and 5 use the Gini and log deviation specialization measures respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 8. Labor Specialization (ILO, 2003) and the Impact of Earthquakes on Final Consumption Expenditures, 1971-2001

Dependant Variable: Change in Final Consumption Expenditures (ΔCON)

	Gini	Gini	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)	(6)	(7)
SPC_{it-1}	-13.378** (6.772)	-16.761 (12.387)	-16.872 (10.624)	-4.561*** (1.474)	-9.073* (5.422)	-5.290 (3.600)
GPC_{it-1}	--	--	0.249 (0.204)	0.340 (0.196)	0.271 (0.179)	0.281 (0.177)
LPO_{it-1}	--	--	12.377 (12.377)	15.469 (11.922)	13.174 (11.803)	12.623 (11.969)
PDN_{it-1}	--	--	-0.040 (0.055)	-0.034 (0.050)	-0.043 (0.056)	-0.047 (0.040)
Year Dummies?	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects?	No	Yes	Yes	Yes	Yes	Yes
R^2	0.16	0.28	0.28	0.31	0.29	0.30
NOB	178	178	178	178	178	178

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. SPC_{it-1}indicates the specialization measure used in the specification; for example columns 4 and 5 use the Gini and log deviation specialization measures respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 9a. Financial Development and Specialization (ILO, 2003): Impact on the Change in Final Household Expenditures, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	(Table 8)	(BMG)	(Table 8)	(BMG)	(Table 8)	(BMG)	(Table 8)	(BMG)
SPC_{it-1}	-21.178** (10.011)	-35.237** (18.176)	-5.488** (1.979)	-12.160*** (3.387)	-12.024** (4.647)	-23.073*** (7.052)	-7.544** (2.867)	-15.358*** (3.569)
BMG_{it-1}	--	-0.339 (0.230)	--	-0.278* (0.162)	--	-0.314 (0.231)	--	-0.264 (0.200)
$SPC_{it-1} * BMG_{it-1}$	--	0.625 (0.416)	--	0.330*** (0.115)	--	0.520* (0.225)	--	0.363** (0.164)
R^2	0.60	0.48	0.50	0.54	0.49	0.51	0.50	0.54
NOB	150	150	150	150	150	150	150	150

Table 9b. Financial Development and Specialization (ILO, 2003): Impact on the Change in Final Consumption Expenditures, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	(Table 9)	(BMG)	(Table 9)	(BMG)	(Table 9)	(BMG)	(Table 9)	(BMG)
SPC_{it-1}	-16.720 (11.447)	-29.548 (22.395)	-4.797** (1.800)	-10.237** (3.689)	-9.056* (5.044)	-20.583** (9.005)	-5.579* (3.062)	-14.181*** (4.582)
BMG_{it-1}	--	-0.328 (0.373)	--	-0.242 (0.160)	--	-0.346 (0.259)	--	-0.303 (0.200)
$SPC_{it-1} * BMG_{it-1}$	--	0.567 (0.553)	--	0.268** (0.128)	--	0.534* (0.295)	--	0.393** (0.184)
R^2	0.596	0.602	0.619	0.645	0.605	0.628	0.610	0.650
NOB	150	150	150	150	150	150	150	150

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicates significance at the 10, 5 and 1 percent levels respectively. All regressions include per capita income, population density, the log of population size as control variables; year and country-specific effects are also included. Columns labeled Table 7 refer to estimating the specification in Table 8 using the current sample; similarly for Table 8.

Table 10a. Timing: Labor Specialization and the Impact of Earthquakes on Household Final Expenditures, 1971-2001

Dependant Variable: The Change in Final Household Expenditures (ΔHCN)

	Gini (2)	Mean Log Deviation (3)	Theil Index (4)	Coefficient of Variation (5)
SPC_{it}	-31.064**	-6.686***	-14.880**	-7.390*
	(15.518)	(1.499)	(6.321)	(4.006)
GPC_{it}	0.145	0.285	0.215	0.203
	(0.205)	(0.256)	(0.253)	(0.247)
PDN_{it}	-0.021	-0.023	-0.022 (0.022)	-0.021
	(0.023)	(0.017)		(0.024)
LPO_{it}	8.535	12.761	9.454	8.358
	(10.460)	(10.997)	(10.335)	(9.761)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.40	0.407	0.411	0.407
NOB	183	183	183	183

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 10b. Timing: Labor Specialization and the Impact of Earthquakes on Final Consumption Expenditures, 1971-2001

Dependant Variable: The Change in Final Consumption Expenditures (ΔCON)

	Gini (2)	Mean Log Deviation (3)	Theil Index (4)	Coefficient of Variation (5)
SPC_{it-1}	-23.783*	-5.650***	-10.928*	-5.190
	(12.662)	(1.258)	(5.819)	(3.801)
GPC_{it-1}	0.259	0.381*	0.310	0.298
	(0.228)	(0.216)	(0.214)	(0.215)
PDN_{it-1}	-0.034*	-0.036**	-0.035*	-0.034*
	(0.019)	(0.014)	(0.019)	(0.020)
LPO_{it-1}	13.80*	17.302**	14.503*	13.732*
	(7.829)	(8.312)	(7.803)	(7.547)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.50	0.52	0.51	0.50
NOB	183	183	183	183

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 11a. Political Institutions, Specialization (ILO, 2003), and the Impact on the Change in Household Expenditures, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	(DEM)	*(CEX)*	*(DEM)*	*(CEX)*	*(DEM)*	*(CEX)*	*(DEM)*	*(CEX)*
SPC_{it-1}	-18.922* (11.363)	-19.027* (12.630)	-4.909*** (1.478)	-4.934*** (1.494)	-10.745** (5.171)	-10.797** (5.186)	-6.531* (3.591)	-6571* (3.599)
DEM_{it-1}	0.147 (0.170)	--	0.178 (0.159)	--	0.141 (0.157)	--	0.157 (0.153)	--
CEX_{it-1}	--	0.228 (0.260)	--	0.282 (0.270)	--	0.238 (0.242)	--	0.267 (0.235)
R^2	0.41	0.41	0.44	0.44	0.43	0.43	0.44	0.44
NOB	175	175	175	175	175	175	175	175

Table 11b. Political Institutions, Specialization (ILO, 2003) and the Impact on the Change in Final Consumption Expenditures, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	(DEM)	*(CEX)*	*(DEM)*	*(CEX)*	*(DEM)*	*(CEX)*	*(DEM)*	*(CEX)*
SPC_{it-1}	-16.010 (11.665)	-15.995 (11.705)	-4.426*** (1.593)	-4.428*** (1.601)	-8.604* (5.365)	-8.586* (5.354)	-5.058 (3.528)	-5.068 (3.521)
DEM_{it-1}	0.102 (0.158)	--	0.125 (0.169)	--	0.103 (0.149)	--	0.118 (0.148)	--
CEX_{it-1}	--	0.194 (0.249)	--	0.234 (0.290)	--	0.207 (0.240)	--	0.233 (0.239)
R^2	0.54	0.54	0.56	0.56	0.55	0.55	0.45	0.55
NOB	175	175	175	175	175	175	175	175

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicates significance at the 10, 5 and 1 percent levels respectively. All regressions include per capita income, population density, the log of population size as control variables; year and country-specific effects are also included.

Table 12. Trade, Specialization (ILO, 2003), and the Impact of Earthquakes on the Change in Consumption, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	ΔHCN	ΔCON	ΔHCN	ΔCON	ΔHCN	ΔCON	ΔHCN	ΔCON
SPC_{it-1}	-20.021** (10.263)	-16.872* (10.623)	-5.061*** (1.376)	-4.561*** (1.476)	-11.141** (4.687)	-8.891* (4.906)	-6.717 (3.367)	-5.195 (3.327)
TRA_{it-1}	0.019 (0.114)	0.022 (0.102)	0.019 (0.114)	0.020 (0.101)	0.016 (0.112)	0.019 (0100)	0.017 (0.109)	0.021 (0.098)
R^2	0.44	0.46	0.47	0.59	0.46	0.59	0.47	0.58
NOB	178	178	178	178	178	178	178	178

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. All regressions include per capita income, population density, and the log of population size as control variables; year and country-specific effects are also included.

Table 13a. Labor Specialization and Household Final Expenditures—Difference from Mean Nonearthquake Value, 1971-2001

Dependant Variable: The Difference Between Household Final Expenditures in the year of an Earthquake And The Mean NonEarthquake Value (ΔHCN)

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)
SPC_{it-1}	-15.730* (9.591)	-4.004* (2.291)	-9.109** (4.426)	-5.041** (2.430)
GPC_{it-1}	0.2** (0.07)	0.2*** (0.06)	0.01** (0.06)	0.01* (0.07)
PDN_{it-1}	-0.004 (0.006)	-0.003 (0.005)	-0.003 (0.006)	-0.003 (0.006)
LPO_{it-1}	-1.380*** (0.379)	-1.547*** (0.422)	-1.313*** (0.368)	-1.313*** (0.372)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	No	No	No	No
R^2	0.41	0.42	0.43	0.43
NOB	180	180	180	180

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively.GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 13b. Labor Specialization and Final Consumption Expenditures—Difference from Mean Nonearthquake Value, 1971-2001

Dependant Variable: The Change in Final Consumption Expenditures (ΔCON)

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)
SPC_{it-1}	-9.740 (10.056)	-2.879 (2.468)	-6.411 (4.609)	-4.149* (2.332)
GPC_{it-1}	0.2*** (0.05)	0.2*** (0.05)	0.2*** (0.05)	0.2*** (0.05)
PDN_{it-1}	-0.005 (0.004)	-0.004 (0.004)	-0.004 (0.005)	-0.003 (0.005)
LPO_{it-1}	-1.535*** (0.373)	-1.629*** (0.391)	-1.465*** (0.356)	-1.426*** (0.366)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	No	No	No	No
R^2	0.45	0.46	0.46	0.47
NOB	180	180	180	180

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 14. Nonearthquake Years and Chi-Squared Tests for Independence: Household Final Expenditures (ΔHCN) and Final Consumption Expenditures (ΔCON) 1971-2001

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation	Percent of Employment in Agriculture
ΔHCN	0.112	0.493	0.075	0.056	0.862
ΔCON	0.199	0.886	0.172	0.099	0.324
Number of Observations	446	446	446	446	329

P-values in rows indicate the probability of rejecting the null hypothesis of independence.

Table 15a. Nonearthquake Years: Labor Specialization and Household Final Expenditures, 1971-2001

Dependant Variable: The Change in Household Final Expenditures (ΔHCN)

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)
SPC_{it-1}	-3.827 (2.531)	0.491 (1.587)	-2.427 (1.640)	-1.575 (1.095)
GPC_{it-1}	0.396 (0.648)	0.060 (0.069)	0.040 (0.006)	0.003 (0.006)
PDN_{it-1}	0.007 (0.009)	0.006 (0.009)	0.007 (0.008)	0.007 (0.008)
LPO_{it-1}	1.841 (1.745)	2.446 (1.824)	1.550 (1.832)	1.037 (1.840)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.18	0.18	0.19	0.19
NOB	438	438	438	438

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 15b. Nonearthquake Years: Labor Specialization and Final Consumption Expenditures, 1971-2001

Dependant Variable: The Change in Final Consumption Expenditures (ΔCON)

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)
SPC_{it-1}	-2.739 (2.688)	0.544 (1.251)	-2.026 (1.608)	-1.498* (0.998)
GPC_{it-1}	0.114 (0.008)	0.129 (0.086)	0.113 (0.081)	0.107 (0.080)
PDN_{it-1}	0.001 (0.011)	0.0006 (0.012)	0.0007 (0.010)	0.001 (0.010)
LPO_{it-1}	4.111** (2.130)	4.580** (2.146)	3.807* (2.222)	3.226 (2.237)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.19	0.19	0.19	0.19
NOB	438	438	438	438

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 16a. Nonearthquake Countries: Labor Specialization and Household Final Expenditures, 1971-2001

Dependant Variable: The Change in Household Consumption (ΔHCN)

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)
SPC_{it-1}	-3.771 (5.226)	0.150 (0.800)	-2.334 (2.645)	-1.600 (1.532)
GPC_{it-1}	0.03 (0.01)	0.04 (0.01)	0.04 (0.01)	0.05 (0.01)
PDN_{it-1}	0.0004 (0.0007)	0.0004 (0.0007)	0.0004 (0.0007)	0.0004 (0.0007)
LPO_{it-1}	2.595 (3.468)	3.696 (3.188)	2.492 (3.379)	2.542 (3.270)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.12	0.11	0.12	0.12
NOB	512	512	512	512

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 16b. Nonearthquake Countries: Labor Specialization and Final Consumption Expenditures, 1971-2001

Dependant Variable: The Change in Final Consumption Expenditures (ΔCON)

	Gini	Mean Log Deviation	Theil Index	Coefficient of Variation
	(2)	(3)	(4)	(5)
SPC_{it-1}	-2.985 (3.489)	0.379 (0.692)	-1.982 (1.653)	-1.599* (0.847)
GPC_{it-1}	0.09 (0.100)	0.09 (0.100)	0.1 (0.100)	0.100 (0.100)
PDN_{it-1}	0.0005 (0.001)	0.0005 (0.0009)	0.0005 (0.001)	0.0005 (0.001)
LPO_{it-1}	4.055 (4.046)	5.186 (4.058)	3.913 (3.936)	3.805 (3.840)
Year Dummies?	Yes	Yes	Yes	Yes
Fixed Effects?	Yes	Yes	Yes	Yes
R^2	0.19	0.19	0.19	0.19
NOB	512	512	512	512

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. GPC_{it-1} is per capita income* 1000. See Table 1 for definition and sources of variables.

Table 17a. Earthquake Magnitude and Specialization (ILO, 2003): Impact on the Change in Final Household Expenditures, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	(Table 8)	(MAG)	(Table 8)	(MAG)	(Table 8)	(MAG)	(Table 8)	(MAG)
SPC_{it-1}	-19.538 (12.821)	-22.064* (12.630)	-5.537*** (1.716)	-5.903*** (1.781)	-11.582** (5.809)	-12.832** (5.792)	-7.309 (3.992)	-8.104** (4.062)
MAG	--	1.341 (1.013)	--	1.353 (0.984)	--	1.421 (0.984)	--	1.485 (0.961)
R^2	0.44	0.46	0.47	0.493	0.46	0.49	0.579	0.50
NOB	162	162	162	162	162	162	162	162

Table 17b. Earthquake Magnitude and Specialization: Impact on the Change in Final Consumption Expenditures, 1971-2001

	Gini		Log Mean Deviation		Theil Index		Coefficient of Variation	
	(Table 9)	(MAG)	(Table 9)	(MAG)	(Table 9)	(MAG))	(Table 9)	(MAG)
SPC_{it-1}	-17.053 (13.446)	-19.310 (13.029)	-5.053** (1.888)	-5.358*** (1.888)	-9.715 (6.133)	-10.740* (6.053)	-6.021 (3.981)	-6.671* (4.041)
MAG	--	1.105 (0.858)	--	1.123 (0.841)	--	1.164 (0.834)	--	1.213 (0.810)
R^2	0.564	0.58	0.590	0.601	0.576	0.564	0.583	0.60
NOB	162	162	162	162	162	162	162	162

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. All regressions include per capita income, population density, the log of population size as control variables; year and country-specific effects are also included. Columns labeled Table 7 refer to estimating the specification in Table 8 using the current sample; similarly for Table 8.

Table 18a. Earthquake Magnitude and Specialization in the Pooled Sample: Impact on the Change in Final Household Expenditures, 1971-2001

	Gini (2)			Log Mean Deviation (3)			Theil Index (4)			Coefficient of Variation (5)		
	Full Sample	Above Med.	Below Med.	Full Sample	Above Med.	Below Med.	Full Sample	Above Med.	Below Med.	Full Sample	Above Med.	Below Med.
SPC_{it-1}	-0.325 (2.482)	10.189** (4.851)	-1.583 (5.292)	0.488 (0.720)	2.850 (1.853)	0.009 (1.046)	-0.297 (1.269)	4.276 (3.274)	-0.691 (2.412)	-0.165 (0.609)	1.109 (1.638)	-0.078 (1.352)
$MAG_{it} \times SPC_{it-1}$	-0.903 (0.606)	0.161 (0.0.818	-0.542 (0.881)	-0.312** (0.115)	0.023 (0.181)	-0.320** (0.166)	-0.443* (0.238)	0.041 (0.388)	-0.323 (0.369)	-0.265* (0.141)	0.051 (0.255)	-0.249 (0.225)
MAG_{it}	0.461 (0.323)	-0.010 (0.409)	0.189 (0.494)	0.260** (0.119)	0.037 (0.171)	0.197 (0.196)	0.215* (0.132)	0.056 (0.198)	0.078 (0.229)	0.139 (0.090)	0.048 (0.150)	-0.078 (1.352)
R^2	0.133	0.198	0.189	0.134	0.201	0.194	0.13	0.195	0.191	0.135	0.190	0.191
NOB	1157	437	438	1157	437	438	1157	437	438	1157	437	437

Table 18b. Earthquake Magnitude and Specialization in the Pooled Sample: Impact on the Change in Final Consumption Expenditures, 1971-2001

	Gini (2)			Log Mean Deviation (3)			Theil Index (4)			Coefficient of Variation (5)		
	Full Sample	Above Med.	Below Med.	Full Sample	Above Med.	Below Med.	Full Sample	Above Med.	Below Med.	Full Sample	Above Med.	Below Med.
SPC_{it-1}	-0.138 (2.316)	7.775 (6.847)	-1.393 (5.054)	0.346 (0.646)	1.601 (1.574)	-0.234 (1.104)	-0.342 (1.263)	2.164 (3.916)	-0.649 (2.318)	-0.244 (0.649)	-0.330 (1.974)	-0.024 (1.285)
$MAG_{it} * SPC_{it-1}$	-0.663 (0.760)	0.195 (0.821)	-0.334 (1.023)	-0.297** (0.154)	-0.019 (0.148)	-0.287 (0.215)	-0.360 (0.295)	0.083 (0.387)	-0.248 (0.420)	-0.224 (0.155)	0.098 (0.252)	-0.216 (0.236)
MAG_{it}	0.351 (0.421)	0.005 (0.416)	0.112 (0.585)	0.265* (0.162)	0.117 (0.138)	0.204 (0.239)	0.189 (0.177)	0.066 (0.198)	0.072 (0.271)	0.134 (0.113)	0.050 (0.150)	0.076 (0.194)
R^2	0.139	0.201	0.159	0.142	0.208	0.164	0.140	0.205	0.160	0.141	0.204	0.161
NOB	1157		438	1157	437	438	1157	437	438	1157	437	438

Huber -White robust standard errors in parenthesis. Regression residual terms are clustered at the country level. *, **, *** indicate significance at the 10, 5 and 1 percent levels respectively. All regressions include per capita income, population density, the log of population size, trade as a percent of GDP, democracy, and the percent of agriculture in value added as control variables; year and country-specific effects are also included. Columns labeled Above Med. (Below Med.) estimate the specification only for those observations above (below) the median level of financial development in the sample.