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Structural Policies for Shock-Prone Commodity Exporters

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Structural Policies for Shock-Prone Commodity Exporters*

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Abstract

Countries that are reliant upon commodity exports periodically face large adverse price shocks. Given past volatility, the present high world prices for commodities may be a precursor to such shocks. Unsurprisingly, adverse price shocks reduce the growth of constant-price GDP and we analyze which structural policies help to minimize these losses. Structural policies are incentives and regulations that are maintained for long periods, contrasting with policy *responses* to shocks, the analysis of which has dominated the literature. We show that structural policies have large effects. In particular, policies which enable flexibility in labour markets and which ease the entry and exit of firms, are particularly well-suited to shock-prone commodity exporters. We show that these gains are systematically unrealized. Indeed, we find a political economy paradox that the larger are the gains from good structural policy, the worse are the policies actually adopted. We account for this paradox in terms of the lack of responsiveness to the needs of the economy that resource rents induce.

Keywords: commodity price shocks; natural disasters; growth, policies

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1. Introduction

Global commodity prices are highly volatile and this makes commodity exporters shock-prone. The analysis of economic policies appropriate for such economies has focused predominantly upon responses to windfalls: notably, how should savings and the exchange rate adjust? Our focus is the precise opposite. Instead of *responses* we consider *structural* policies that are maintained over long periods, affecting economic performance either through regulation or incentives. Rather than *windfalls* we consider adverse shocks. With commodity prices currently at historically high levels it is appropriate for governments to consider the precautionary adoption of structural policies that would enable the economy to cope with future price declines. We establish which structural policies are best-suited to such shocks.

In principle, it should be far easier for a government to get structural policies right than to get policy responses right. Response requires that a government be fleet of foot, and may also require it to make a correct assessment as to how the shock will evolve. In contrast, appropriate structural policies do not need to be adopted in haste: a government that recognizes that its economy is prone to shocks can gradually put in place such policies as precautionary and subsequent governments can maintain this legacy without further action. We show that the pay-off to the adoption of appropriate structural policies is substantial, ranging up to the equivalent of 30% of a year's GDP. Further, we find a paradox of political economy. Whereas it might be expected that the higher are the pay-offs to good structural policies the more likely is a government to have adopted them, we find the opposite: the more that a resource-rich country has to gain from appropriate structural policies the less likely it is to have them. In

attempting to account for this paradox we provide a new twist to the familiar story of the 'resource curse'.

The paper is structured as follows. In Section 2 we discuss our methodology and our data. Section 3 presents our core results and Section 4 tests their robustness. Section 5 uses the results to estimate the pay-off to appropriate policies and analyzes the political economy of whether such policies are adopted. Section 6 concludes.

2. Methodology and Data

Our estimation strategy involves two steps. We first test the effects of adverse shocks on growth. Having established their adverse effects, we then investigate the consequences of various structural policies in mitigating the losses.

Measuring Shocks

The first step is to construct a measure of adverse shocks. We consider two distinct types of shock, each likely to be exogenous: large declines in the price of a country's commodity exports, and severe natural disasters.

We use the commodity export price index of Collier and Goderis (2008) to construct measures of commodity export price shocks. The index was constructed using the methodology of Deaton and Miller (1995) and Dehn (2000). We collected data on world commodity prices and commodity export values for as many commodities as data availability allowed. Table 1b lists the 50 commodities in our sample. For each

country we calculate the total 1990 value of commodity exports. We construct weights by dividing the individual 1990 export values for each commodity by this total. These 1990 weights are then held fixed over time and applied to the world price indices of the same commodities to form a country-specific geometrically weighted index of commodity export prices. We use the log of this index, weighted by the 1990 level of commodity exports over GDP, as a long run control variable in our estimations.

We next use the log of the index (not yet weighted by the level of exports) to construct measures of commodity export price shocks. We define shocks as episodes with large changes in commodity export prices. In our core results we follow Collier and Dehn (2001) in removing the predictable component of shocks. Specifically, we take the first difference of the log commodity export price index and then remove its predictable component by running the following forecasting estimation model:

$$\Delta I_{i,t} = \alpha_0 + \alpha_1 t + \beta_1 \Delta I_{i,t-1} + \beta_2 I_{i,t-2} + \varepsilon_{i,t} \quad (1)$$

where $I_{i,t}$ is the log commodity export price index and t is a linear time trend. We collect the residuals $\varepsilon_{i,t}$ from equation (1) and calculate the 10th and 90th percentile of their distribution. However, our results are not dependent upon the exclusion of the predictable component. Indeed, the extreme shocks on which we focus are virtually unpredictable from past price information so that any such adjustment makes only a negligible difference. Positive and negative commodity export price shock episodes are defined as the observations with residuals above the 90th or below the 10th percentile, respectively. For robustness we will also estimate the effect of shocks

using the 5th and 95th percentile as thresholds. Having identified the shock episodes, we next construct two variables. The first captures *positive* commodity export price shocks and equals the first log difference of the commodity export price index for the *positive* shock episodes, and zero otherwise. The second captures *negative* commodity export price shocks and equals minus the first log difference of the commodity export price index for the negative shock episodes, and zero otherwise. Finally, to allow the effect of commodity export price shocks to be larger for countries with larger exports, we weight the two variables by the share of commodity exports in GDP. Our estimation sample contains 377 positive shock episodes and 392 negative shock episodes.

The natural disasters we consider are geological, climatic, and human disasters (Raddatz, 2007). We include only episodes that qualify as 'large' disasters according to the criteria established by the International Monetary Fund (IMF, 2003). Our estimation sample contains 688 episodes with one or more large natural disasters.

We also introduce political shocks from civil war and coup d'etats, but these are included merely as controls rather than as a focus of our analysis.

Effects of Shocks on Growth

We analyze the effects of shocks by estimating the error-correction model in equation (2) below.[4]

[4] This model is based on Collier and Goderis (2008), who report panel unit root and cointegration tests.

$$\Delta y_{i,t} = \alpha_i + \delta' z_{i,t} + \lambda y_{i,t-1} + \beta_1' x_{i,t-1} + \beta_2 \Delta y_{i,t-1} + \beta_3' \Delta x_{i,t-1} + \sum_{j=0}^{1} \beta_4' s_{i,t-j} + \sum_{j=0}^{1} \beta_5' p_{i,t-j} + \sum_{j=0}^{1} \sum_{q=1}^{k} \beta_{6q}' (s_{i,t-j})(p_{i,t-j,q}) + u_{i,t} \quad (2)$$

where the subscripts $i = 1,\ldots N$ and $t = 1,\ldots T$ index the countries and years in the panel, respectively. $y_{i,t}$ is log real GDP per capita in country i in year t, α_i is a country-specific fixed effect, and $z_{i,t}$ is an $rT \times 1$ vector of regional year dummies, where r is the number of regions.[5] $x_{i,t-1}$ is an $m \times 1$ vector of m variables that are expected to affect GDP in the long run and in the short run. We include three control variables from the empirical growth literature: trade openness, measured as the ratio of trade to GDP; inflation, measured as the log of 1 plus the annual consumer price inflation rate; and international reserves over GDP. We also include our constructed commodity export price index and an oil import price index to control for the long run effect of commodity export and oil import prices. The vector $s_{i,t-j}$ consists of n variables that are expected to have only a short-run effect on growth and includes our measures of commodity export price shocks and natural disasters.

Our key interest is in the vector $p_{i,t-j}$ of k indicators of policies that could potentially mitigate the adverse growth effects of commodity export price shocks and natural disasters. Some of these structural policies are standard in the analysis of shocks, notably financial depth (Beck et al., 2000), financial openness (Chinn and Ito, 2006), remittances (Global Development Finance) and international reserves

[5] We include the following regions: Central and Eastern Europe and Central Asia, East Asia and Pacific and Oceania, Latin America and Caribbean, North Africa and Middle East, South Asia, Sub-Saharan Africa, and Western Europe and North-America.

(International Financial Statistics). The key contribution of this paper is to add indicators that capture the flexibility of labour markets and the flexibility of firm entry and exit, all based on the 'Doing Business' surveys of the World Bank. We also control for two policies that have already been shown to mitigate the adverse effects of terms-of-trade shocks: exchange rate flexibility (Broda, 2004) and foreign aid (Collier and Goderis, forthcoming). The interaction of $s_{i,t-j}$ and $p_{i,t-j}$ in equation (2) tests whether these structural policies mitigate the effects of shocks.

Our dataset consists of all countries and years for which data are available, and covers around 130 countries between 1963 and 2003. Table 1a reports summary statistics for the variables used in estimation. Data description and sources can be found in the data appendix.

3. Estimation Results

Preliminaries

The results of estimating equation (2) are reported in Table 2. We first simply investigate whether shocks matter for growth, the interaction effects being introduced later.

The coefficients for commodity export price shocks and natural disasters all have the expected signs. Negative price shocks lower growth, both in the same year and in the next, but the effect is much larger and significant at 1 percent in the year after the

shock.[6] The size of the coefficient suggests that for countries like Nigeria and Zambia, where commodity exports represent 35 percent of GDP, a negative commodity export price shock of 30 percent lowers growth in the next year by 0.346*0.35*0.30 = 3.6 percentage points. Positive price shocks have a positive effect on growth, but the effects are not statistically significant. The coefficient for natural disasters is negative and significant at 5 percent: the typical large natural disaster lowers growth by 0.37 percentage points.[7]

We next turn to the other variables in Table 2. The long-run coefficients for trade openness, inflation, and international reserves have the expected sign and are all statistically significant. The long-run effect of commodity export prices is negative, which is consistent with the "resource curse" finding in Collier and Goderis (2008). The long run effect of higher oil prices on oil importing countries is negative but not significant. The short-run adjustment coefficient is highly significant and suggests a speed of adjustment to long run equilibrium of around 6 percent per year.

The short-run coefficients all have the expected sign but are sometimes insignificant. The lagged dependent variable enters positive and significant at 1 percent, while the two indicators of political violence – coups and civil wars – have unsurprisingly large adverse effects on growth. A coup appears to cut growth by around 3.1 percentage points in the same year, while for wars this effect is 2.2 percentage points.

[6] We experimented with additional lags but they proved to be unimportant.

[7] We divided the number of disasters by 10 to make the scale of the indicator more comparable to the scale of the other variables in our model.

Shocks and Policies

Having established that both negative commodity export price shocks and natural disasters have significant adverse growth effects, we now investigate policies that could potentially mitigate these effects. Two such policies have already been shown to effectively mitigate the growth effect of adverse commodity export price shocks. The first, exchange rate flexibility, has long been recognized for its ability to insulate economies against shocks in general (Friedman, 1953) and terms-of-trade shocks in particular (Broda, 2004). As shown by Collier and Goderis (forthcoming) it also dampens commodity export price shocks. However, since very few governments allow their currency to float freely, exchange rate flexibility is about policy responses rather than being a structural policy.

The second policy that has been shown to mitigate shocks is the provision of development assistance (Collier and Goderis, forthcoming). Higher levels of aid lower the exposure of an economy to import compression resulting from a shock to commodity export earnings: a given absolute shock will require a smaller proportionate reduction in imports. Aid might also finance liquidity or investments in human capital and infrastructure, which enhance the flexibility of an economy and thereby its ability to cushion shocks. This is a genuine structural policy since it is concerned not with aid responses to shocks but to pre-shock levels. However, it is evidently not under the control of the governments of recipient countries.

We next add our indicators of exchange rate flexibility and aid to the specification of Table 2, both individually and interacted with each of the four commodity export

price shocks.[8] We focus on the lagged negative export price shock since this has by far the largest growth impact. Table 3, column (1), reports the interactions of this variable with exchange rate flexibility and aid. All three coefficients have the expected signs and are highly statistically significant, supporting the hypotheses that exchange rate flexibility and aid mitigate commodity export price shocks. Table 3, column (6), shows the same results for natural disasters. We find no evidence that either exchange rate flexibility or aid significantly cushion the effect of natural disasters on growth but this may simply be because the impact of the typical natural disaster on growth is far smaller than that of the typical large adverse price shock.

We next investigate alternative policies that could mitigate shocks. The first two, financial depth and financial openness, can be thought of as policies that increase the capacity of private agents to respond to shocks (flexibility), enabling faster reallocation of capital.[9] As can be seen from the interactions between shocks and financial depth in Table 3, columns (2) and (7), we do not find evidence that financial depth significantly reduces the adverse effects of shocks. Financial openness does not significantly cushion shocks either: rather it seems to amplify them. This might reflect a disadvantage often attributed to financial openness. While it makes it easier to attract capital, it also makes it easier for capital to leave the country. Especially in financially open countries with high levels of short-term debt denominated in foreign currency, an adverse commodity export price shock may trigger capital outflows that

[8] Since aid is likely to be endogenous, we estimate its effect using two-stage-least-squares estimation, following the methodology of Tavares (2003). See Collier and Goderis (forthcoming) for details.

[9] Financial depth and financial openness, as well as some of the other policies considered in this paper, were earlier used by Loayza and Raddatz (2007) to investigate how structural characteristics influence the impact of terms of trade shocks on aggregate output.

further deteriorate corporate balance sheets or the government's fiscal position and could amplify the growth effect of the shock.

We next investigate whether a country's level of international reserves can mitigate the adverse effect of shocks. Reserves can be thought of as a quasi-insurance or precautionary instrument. However, the precautionary investment is only valuable if the government chooses to respond to an adverse shock by depleting reserves. Our results find no significant effect of reserves, a result consistent with the notion that governments find it difficult to get policy responses right.

The fourth policy we consider is the level of a country's remittances. Of course, remittances are not directly a policy, but governments can over time either encourage or discourage them through related financial and educational policies. Globally, remittance flows now exceed aid flows. And since remittances to developing countries provide a direct household-to-household transfer, their effect may be different from the effect of aid, which is predominantly the preserve of the public sector. However, the interaction effects of remittances with the shock variables in Table 3, columns (5) and (10) are far from statistically significant and hence do not provide any evidence to support the hypothesis that remittances mitigate shocks. Summarizing, we have found that exchange rate flexibility and foreign aid mitigate the effects of adverse commodity export price shocks but the other policies considered here do not seem to cushion shocks.

Labour Market Policies

Governments control an array of policies that affect the functioning of labour markets. Because employment is politically sensitive, there is a wide range in the degree to which governments regulate labour markets, permitting flexibility. We might expect that the ability of economic actors to respond to shocks is influenced partly by the speed of price responses and partly by reallocations of labour. In countries with more flexible labour markets, labour can more easily be reallocated from sectors or regions that are hit by the shock.

We investigate the importance of labour market flexibility using indices of employment flexibility that were calculated from data of the 'Doing Business' surveys of the World Bank. The Doing Business project started in 2004 and provides measures of business regulations and their enforcement across 178 countries.[10] Part of the project focuses on the regulation of employment and includes a composite index of 'rigidity of employment', which is the average of 3 sub-indices: a difficulty of hiring index, a rigidity of hours index, and a difficulty of firing index. All indices have ordinal scales. Our composite measure of employment flexibility is a dummy variable that takes a value of one if a country's average value of the 'rigidity of employment' index between 2004 and 2007 in Doing Business is below its median value for all countries and zero if it is above its median value. We also construct three dummy variables for ease of hiring, ease of firing, and flexibility of hours, based on

[10] The methodology of the Doing Business indicators used in this paper was developed in Djankov et al. (2002), Botero et al. (2004), and Djankov et al. (2006).

the 2004-2007 averages of the three sub-indices in Doing Business and constructed in the same way as the dummy variable for employment flexibility.[11]

In Table 3, column (11), we add an interaction of our indicator of employment flexibility with the commodity export price shock to the estimation specification.[12] The shock again enters negative and statistically significant at 1 percent, indicating that a country without shock cushioning policies suffers a significant growth loss. However, the interaction of the shock with our indicator of employment flexibility enters positive and significant at 5 percent, which indicates that countries with relatively high degrees of labour market flexibility suffer significantly less from adverse commodity export price shocks. Hence, labour market flexibility mitigates adverse commodity export price shocks. The effect is large. For countries like Nigeria and Zambia, with commodity exports of 35 percent over GDP, a negative commodity

[11] Our measures of employment flexibility are thus time invariant and based on the period 2003-2007 only. However, the time series show an extremely high persistence over this period. This is not surprising, as any changes in labour market institutions are likely to occur very slowly. We therefore believe that our measures can be used as proxies for labour market structural policies in all sample years.

[12] We do not add employment flexibility by itself as it is time invariant and is therefore captured by the country fixed effects. Although we are primarily interested in whether flexibility cushions shocks, we did investigate its direct effect on growth, using the specification of Table 4, column (6), discussed below. We collected the fixed effects of this regression and regressed them on flexibility and controls from Sachs and Warner (1995). Using five different sets of controls, employment flexibility always enters with a positive sign but is never statistically significant. However, when we simply use average growth as the dependent variable, instead of the fixed effects, we find a positive and significant effect of employment flexibility. This suggests that part of the positive effect of labour market flexibility on average growth occurs through the mitigation of shocks (natural disasters in this specification).

export price shock of 30 percent lowers growth in the next year by around 10 percentage points, in the absence of shock mitigating policies. With labour market flexibility this growth loss is only around 5.5 percentage points, everything else equal.

In Table 3, column (16), we report the results for natural disasters. Again, the shock by itself enters with a negative sign and is significant at 5 percent, while the interaction with employment flexibility enters positive and also significant at 5 percent. This indicates that labour market flexibility also cushions the effects of natural disasters. While the average natural disaster lowers growth by 1.5 percentage points in countries with no mitigating policies, this growth loss is only 0.5 percentage point in countries with a flexible labour market.

We next decompose the effect of employment flexibility by substituting the composite indicator by the three sub-indices. The results for commodity export price shocks are reported in Table 3, column (12). The interaction of shocks with the sub-index ease of firing enters positive and significant at 5 percent, which indicates that countries in which it is easier to fire employees suffer significantly less from adverse commodity export price shocks. The interaction of shocks with flexibility of hours, which captures how easy it is for a firm to change the working hours of its employees, also enters with the expected sign but is not significant. Ease of hiring enters with a negative sign and is not significant either. Hence, the cushioning effect of labour market flexibility seems to stem primarily from more flexible procedures for firing workers. An implication is that an important part of the growth loss after an adverse commodity export price shock is explained by the inability of firms to lay off redundant workers.

The results for natural disasters are reported in Table 3, column (17). The interactions of the shock with ease of hiring and ease of firing enter with a positive sign and are statistically significant at 5 and 10 percent, respectively, while the interaction of the shock with flexibility of hours has a negative sign and is not significant. This suggests that the mitigating effect of labour market flexibility after natural disasters is explained by more flexible procedures for hiring and firing workers. Perhaps the recovery from natural disasters is speeded if firms are able quickly to terminate some economic activities, while initiating the reconstruction process.

In addition to the regulation of employment, Doing Business also studies the regulation of firm exit and entry. This involves all procedures that entrepreneurs have to follow in order to close down or start up a business. Since the ability of an economy to reallocate capital and labour after a shock is likely to depend on the flexibility of entrepreneurs to close down or start up businesses, we next investigate whether the flexibility of firm exit and entry mitigates the adverse effects of shocks.

Our measure of speed of firm exit is based on the average 2004-2007 value of the variable 'time to close a business' in Doing Business, which we rescaled to range from 0 to 1, with higher values indicating a higher speed of firm exit. The time to close a business is calculated for a limited liability company in the country's most populous city, which has a hotel as its major asset and employs 201 employees. It varies between 5 months and 10 years. Although this refers to a particular business and may not be fully representative for commodity exporting firms in resource-rich economies, the data are comparable across countries and are therefore a useful tool in

our analysis. In addition, although the procedures for closing a business will often extend beyond the growth impact of a shock, the speed with which they can be completed may still be of importance in mitigating shocks. One reason is that adverse shocks can lead to a severe reduction in lending or even a credit crunch. Such liquidity problems are much more likely to occur in countries with lengthy and disorderly bankruptcy procedures. If investors face years of litigation and uncertainty, they will be much less inclined to provide new loans and in the worst case a country's liquidity will fully dry up. This problem has attracted considerable attention in the literature on financial crises. After the Asian crisis of 1997 and 1998, firms and financial institutions in Indonesia for many years continued to suffer from non-performing loans on their balance sheets. This failure to restructure can amplify the shock *ex ante*, as investors will be more reluctant to keep lending. It could even keep investors from lending long-term to commodity exporting firms in resource-rich economies. These firms will then have large short-term exposures, which can lead to financial accelerator effects in case of negative shocks. The initial impact of an adverse commodity export price shock will be amplified through its effect on the balance sheets of commodity exporting firms.

Table 3, column (13), reports the estimation results when adding an interaction of the commodity export price shock with the speed of firm exit to our specification.[13] As

[13] We do not include the speed of firm exit indicator individually as it is time invariant and is therefore captured by the country fixed effects. To test the direct effect of speed of firm exit on growth, we collected the fixed effects from the regression of Table 4, column (1), discussed below, and regressed them on the speed of firm exit and controls from Sachs and Warner (1995). Using five different sets of controls, speed of firm exit always enters with a positive sign, while the statistical significance of its

before, the shock enters with a negative sign and is statistically significant at 1 percent. However, the size of the coefficient is much larger than before, which indicates that countries with no cushioning policies suffer severely from adverse commodity export price shocks. The interaction of the shock with the speed of firm exit enters positive and is also significant at 1 percent, suggesting that countries with faster bankruptcy procedures suffer significantly less from export price shocks. The non-linear effect is big. For a country like Indonesia, with commodity exports of 15 percent over GDP, a negative commodity export price shock of 30 percent lowers growth in the next year by around 5.2 percentage points, in the absence of flexible exchange rates and aid and with a speed of firm exit at the 10th percentile of the sample distribution (which equals the actual speed of firm exit in Indonesia). If Indonesia were to increase its speed of firm exit to the 90th percentile of the sample distribution, this growth loss would fall from 5.2 percentage points to around 0.8 percentage points. These results suggest that the speed of bankruptcy procedures is very important for the ability of countries to cope with adverse commodity export price shocks.

In Table 3, column (14), we add the speed of firm entry[14] to the specification of column (13), while in column (15), we add both the speed of firm entry and the flexibility of employment. In both specifications, the shock as well as the interaction of the shock with the speed of firm exit enter with the same signs as before and

coefficient is 10 percent or higher in three of the five specifications. This suggests that speed of firm exit has a positive effect on average growth, over and beyond its effect through shock mitigation.

[14] Our measure of speed of firm entry is based on the logged average 2004-2007 value of the variable 'time to start a business (in days)' in Doing Business, which we rescaled to range from 0 to 1, with higher values indicating a higher speed of firm entry.

remain highly statistically significant, while the size of the coefficients is relatively stable. The interactions of the shock with the speed of firm entry enter positive but are not significant, indicating that speed of entry does not significantly cushion adverse commodity export price shocks. The horse race in column (15) reveals that the effect of speed of firm exit dominates the effect of employment flexibility that we found in columns (11) and (12).

Having established that the speed of firm exit mitigates the adverse effect of commodity export price shocks, we next investigate whether it also mitigates the adverse effect of natural disasters. Table 3, column (18), reports the estimation results when adding an interaction of the number of natural disasters with the speed of firm exit indicator to our specification. Although the interaction of the shock with the speed of firm exit enters with a positive sign, the coefficient is not statistically significant, suggesting that the speed of bankruptcy procedures does not significantly cushion the adverse effect of natural disasters. In Table 3, column (19), we add the speed of firm entry to the specification of column (18), while in column (20), we add both the speed of firm entry and the flexibility of employment. In both specifications, the interactions of the shock with the speed of firm exit and entry are not significant, while the interaction of the shock with the flexibility of employment remains positive and significant at 5 percent and has the same size as in column (16). We take this as evidence that for natural disasters it is really the flexibility of employment that is important in cushioning shocks rather than the speed of firm exit or entry.

4. Endogeneity and Sensitivity

We now consider the robustness of our results. We first repeat the estimation of Table 3, column (13), but without the indicators of exchange rate flexibility and aid and their interactions with shocks. These interactions were no longer statistically significant and excluding them substantially increases the sample size. The results are reported in Table 4, column (1). The lagged adverse commodity export price shock again enters with a negative sign and remains statistically significant at 1 percent, although the size of the coefficient is smaller. The interaction of the shock with speed of firm exit again enters positive and is significant at 5 percent, while the size of the coefficient is again smaller than before. Hence, our finding that speed of firm exit mitigates export price shocks is robust to extending the sample size, which is around 2.5 times larger than before. We also performed this robustness check for natural disasters by repeating the estimation of Table 3, column (16), but without the indicators of exchange rate flexibility and aid and their interactions with shocks. The results are reported in Table 4, column (6). Again, the sample size increases substantially, while the coefficients of the shock and its interaction with employment flexibility gain significance and are now both significant at 1 percent, although smaller in size. Hence, our finding that labour market flexibility cushions the adverse effects of natural disasters is strongly robust to extending the sample size.

A possible concern with these estimation results is that the explanatory variables are endogenous, i.e. correlated with the error term in equation (2). Endogeneity could potentially relate to the shocks, the policies, or both. Natural disasters, for example, may occur more often in countries with particular geographical characteristics that could also affect growth. However, since our estimation model includes country-specific fixed effects, we effectively control for all time invariant growth

determinants, including a country's geography. Hence, our indicator of natural disasters is not likely to suffer from endogeneity. Adverse commodity export price shocks, on the other hand, *may* be endogenous to the extent that some exporters may have an influence over the world price of the commodities that they export. If the world prices are indeed affected by the actions of some large commodity exporters, the assumption of exogeneity may be violated. To address this concern, we express each country's exports of a given commodity as a share of the total world exports of that commodity and repeat this for all other commodities in our sample. This yields a list of commodity export shares that reflect the importance of individual exporters in the global markets for individual commodities. We found that of the 129 countries in our sample, 22 countries export at least one commodity for which their share in world exports exceeds 20 percent. We investigate whether the inclusion of these major exporters in our sample affected our results by re-estimating the specification in Table 4, column (1), but without these 22 countries. The results, available upon request from the authors, show that our findings are strongly robust to the exclusion of major exporters of individual commodities. In fact, the coefficients for the shock and the interaction of the shock with the speed of firm exit were -1.18 and 1.20, respectively, while the significance levels of the coefficients were identical to the ones in Table 4, column (1). This shows that our results are not affected by the large exporters in our sample and hence casts doubt on the hypothesis that the coefficient of our commodity export price shock is biased.

Another possible source of endogeneity is the policy variables. Even though they are time invariant, the interactions between the shocks and these policy variables may be endogenous. For example, if speed of firm exit and flexibility of employment are

correlated with other (omitted) structural characteristics or policies that mitigate shocks, then we might wrongfully attribute the mitigating effects to speed of firm exit and flexibility of employment. We address this issue by instrumenting for speed of firm exit and flexibility of employment. For the speed of firm exit, we use the legal origin of countries (English, Socialist, French, German, or Scandinavian) from La Porta et al. (1999) as an instrument. Djankov et al. (2006) show that their composite indicator of the efficiency of debt enforcement, in which speed of firm exit is an important component, is strongly correlated with legal origin. In particular, countries with French legal origin have the lowest level of efficiency of debt enforcement, while Nordic and common law countries have the highest. This variation is not explained by per capita income. Djankov et al. (2006) argue that the less efficient debt enforcement procedures in countries with French legal origin may be due to excessive formalism in such countries.

Since the speed of firm exit is time invariant and hence does not enter our fixed effects regressions by itself, the potential endogeneity can only be reflected in the interaction of the speed of firm exit with the export price shock. Following Goderis and Ioannidou (2008) and based on Wooldridge (2002), we construct an instrument for this interaction term in the following way. We run a regression of the speed of firm exit on English, French, German, and Scandinavian legal origin for the estimation sample of Table 4, column (1). All legal origin indicators are statistically significant. Compared to the omitted category of Socialist legal origin, countries with English, German, or Scandinavian legal origin have a statistically higher speed of firm exit, while countries with French legal origin have a significantly lower speed of firm exit, consistent with Djankov et al. (2006). We collect the fitted values of this

regression and interact these with the commodity export price shocks. This yields an instrument for the interaction of the speed of firm exit with the export price shock in Table 4, column (1). For this instrument to be valid, it should not be dependent on growth, should not be correlated with any omitted variables that drive growth, and should not by itself have an effect on growth other than through the endogenous regressor (exclusion restriction). Since legal origin was established long before the start of our sample period, we do not believe it depends on growth in recent decades. We also do not believe it is correlated with other policies that mitigate shocks.[15] And finally, it is difficult to see how the interaction term of shocks with legal origin that we use as an instrument would affect growth, other than through the mitigating effect of the speed of firm exit.

Having constructed an instrument for the interaction in Table 4, column (1), we now run a two-stage-least-squares estimation procedure. We instrument for the interaction in Table 4, column (1), as well as the interactions of the speed of firm exit with the positive commodity export price shocks and the contemporaneous negative commodity export price shock. In the first stage, we regress each of the endogenous regressors on the instruments and the other explanatory variables. The relevant instrument enters positive and statistically significant at 1 percent for each of the four endogenous interaction terms. We then use the predicted values of the first stage in the second stage. The results of this second stage are reported in Table 4, column (2).

[15] It should be noted that legal origin is correlated with indicators of investor protection, as in La Porta et al. (1997, 1998). However, if investor protection mitigates commodity export price shocks, it is probably because it implies debt enforcement mechanisms that safeguard the interests of investors. The speed of firm exit is an important component of debt enforcement and investor protection. Hence, any shock mitigating effect of investor protection is entirely consistent with our findings.

Both the lagged adverse commodity export price shock and its (instrumented) interaction with the speed of firm exit enter with the same sign and significance as in column (1). In fact, the size of the coefficients is identical. This suggests that our uninstrumented results in column (1) do not suffer from any endogeneity bias. Not surprisingly, a Davidson-MacKinnon test of exogeneity did not reject the null hypothesis of a consistent estimate for the uninstrumented interaction term in Table 4, column (1), with a p-value of 0.98. We conclude that our finding that the speed of firm exit mitigates adverse commodity export price shocks is not likely to be explained by endogeneity.

We next perform the same procedure for natural disasters to address the potential endogeneity of its interaction term with the flexibility of employment in Table 4, column (6). For the flexibility of employment, we use an indicator[16] of majoritarian electoral systems from Persson and Tabellini (2003) as an instrument. A majoritarian system can be viewed as the opposite of a proportional electoral system. Proportional systems tend to have more than two political parties and often have multi-party coalition governments. Proportional representation is therefore an important determinant of what Lijphart (1999) calls 'consensus democracy'. Lijphart argues that consensus democracies, in which multiple parties with diverse constituencies deliberate, produce gentler policies and are more inclusive when it comes to the interests of minorities. Lijphart finds that consensus democracies are characterized by low incarceration rates, less use of the death penalty, better care for the environment,

[16] This variable equals the average 1990-1998 value of a dummy that takes a value of one if all the lower house is elected under plurality rule, and zero otherwise. Only legislative elections (lower house) are considered.

and larger budgets for foreign aid and welfare spending. Although Lijphart does not explicitly investigate labour regulation, one would expect that countries with proportional electoral systems have stronger protection of worker rights and thus less flexible labour markets, and vice versa for countries with majoritarian systems.

Since the flexibility of employment is time invariant and hence does not enter our fixed effects regressions by itself, we again construct an instrument for its interaction with shocks. We run a probit regression of the flexibility of employment on the indicator of majoritarian electoral systems for the estimation sample of Table 4, column (6). The indicator of majoritarian systems enters with a positive sign and is statistically significant at 1 percent, which indicates that countries with majoritarian systems have more flexible labour markets than countries with proportional systems, as we predicted. We collect the fitted values of the probit regression and interact these with the indicator of natural disasters. This yields an instrument for the interaction of natural disasters with the flexibility of employment in Table 4, column (6).

Since political institutions tend to be very persistent, we believe that electoral systems are for the most part predetermined and do not depend on growth in the last decades. It also does not seem likely that a majoritarian electoral system has a direct effect on the impact of natural disasters. However, for the instrument to be valid, it should not be correlated with other policies that mitigate shocks. This requirement is less likely to be fulfilled. Majoritarian systems are less inclusive and so may be less responsive to natural disasters that affect only a minority. If this amplifies the adverse growth effect of natural disasters, our instrument will not be exogenous. However, this implies that majoritarian systems should be *less* effective in mitigating the growth

effect of natural disasters, while our instrumentation strategy is based on the assumption that majoritarian systems have more flexible labour markets and should therefore be *more* effective. In other words, not controlling for the amplifying effect of majoritarian systems through lower government responsiveness, should bias our results towards finding that labour market flexibility does not mitigate shocks.

Having constructed an instrument for the interaction in Table 4, column (6), we again perform an instrumental variables estimation procedure. The instrument enters positive and is statistically significant at 1 percent in the first stage regression. The results of the second stage are reported in Table 4, column (7). The number of natural disasters again enters with a negative sign and has the same coefficient as in column (6), although no longer significant. The interaction of the shock with the flexibility of employment enters with a positive sign. The size of the coefficient is only slightly smaller than in column (6) but is no longer statistically significant. A Davidson-MacKinnon test of exogeneity did not reject the null hypothesis of a consistent estimate for the uninstrumented interaction term in Table 4, column (6), with a p-value of 0.46. This provides some evidence that any endogeneity bias is likely to be small and in any case does not bias the results towards finding that labour market flexibility mitigates the growth effects of natural disasters.

Having addressed concerns of endogeneity, we next investigate whether our results are robust to alternative shock measures. Recall that our commodity export price shock episodes were defined as the observations with residuals above the 90^{th} or below the 10^{th} percentile in the estimation specification of equation (1). For sensitivity, we change these thresholds to the 95^{th} and the 5^{th} percentile, which reduces the number of shock episodes. Using this alternative measure of shocks, we

re-estimate the specification in Table 4, column (1). The results, reported in Table 4, column (3), show that the estimated coefficients are strongly robust and even gain in size and statistical significance.

As a second robustness check, we reconstruct the commodity export price shocks using a different criterion to identify shock episodes. Instead of using equation (1) to remove the predictable component of shocks, we now simply define shock episodes as the observations for which the first difference of the (not yet weighted) log commodity export price index either lies above the 90^{th} percentile of its distribution (positive shocks) or below the 10^{th} percentile (negative shocks). Again, our results are strongly robust to this alternative specification. Both the signs of the coefficients and their statistical significance are identical to the ones in Table 4, column (1), while the size of the coefficients is very similar (-1.12 and 1.16 versus -1.14 and 1.19 for the original shock measure). These additional estimation results are available upon request from the authors.

We also test the robustness of our results for natural disasters by replacing the indicator of the number of natural disasters by a dummy variable that takes a value of one if a country has one or more disasters in a given year, and zero otherwise. This tests the degree to which our results are driven by countries that experienced more than one disaster in a given year. The results, reported in Table 4, column (8), show that our results are again strongly robust to this alternative shock measure.

We next investigate whether the effects vary across different types of shocks. For commodity export price shocks, we distinguish between non-agricultural price shocks

and agricultural price shocks and construct measures for each of these, using the methodology described in section 2.1. We also construct interactions of both of these measures with the speed of firm exit. We replace the shock and its interaction with speed of firm exit in Table 4, column (1), by the two separate shock measures and their interactions with speed of firm exit and rerun the specification. The results are reported in Table 4, column (4). The non-agricultural price shock enters with a negative sign and its coefficient is statistically significant at 1 percent. The interaction of non-agricultural price shocks with speed of firm exit has a positive sign and is significant at 5 percent. Hence, the results for non-agricultural shocks are entirely consistent with the results we found for the general commodity export price shocks. By contrast, the agricultural price shock and its interaction with speed of firm exit have the opposite signs, while their coefficients are far from statistically significant. This indicates that our finding that adverse commodity export price shocks harm growth and that this effect is mitigated by a high speed of firm exit, was driven by the non-agricultural commodity export price shocks in our sample. An evident distinction between the revenues from the extractive sector and those from the agricultural sector is that in the former sizeable revenues accrue to the government whereas in the latter revenues accrue predominantly to farmer households. The difference in the consequences of shocks for growth may be because households are more adept at responding to shocks than governments.

For natural disasters, we replace the total number of disasters and its interaction with employment flexibility in Table 4, column (6), by three separate variables that capture the number of geological, climatic, and humanitarian disasters and interactions of each of these variables with employment flexibility. The results are reported in Table

4, column (9). The indicator of geological shocks enters with a negative sign and is statistically significant at 10 percent, while its interaction with the flexibility of employment has a positive but insignificant coefficient. The size of both coefficients is larger than the size of the coefficients in column (6), suggesting that the results for geological shocks, although less significant, are consistent with the general effects found in column (6) or even slightly stronger. The coefficients for climatic shocks are almost identical to the ones in column (6), both in terms of size and statistical significance, suggesting that our findings for natural disasters are predominantly driven by climatic shocks. By contrast, the indicator of humanitarian disasters and its interaction with employment flexibility enter with signs opposite to the signs of the coefficients in column (6), while their coefficients are not significant. This indicates that humanitarian disasters do not matter much for growth and that any effect they might have is not mitigated by labour market flexibility.

As a final robustness check, we strip the specifications in Table 4, columns (1) and (6), by removing the vector of long-run GDP determinants, $x_{i,t-1}$, and the lagged level of GDP per capita, $y_{i,t-1}$. This transforms the model from a cointegration model to an autoregressive distributed lag (ARDL) model. The results from estimating this ARDL model are reported in Table 4, columns (5) and (10). Our results are strongly robust to this alternative specification. Both the effects of the shocks and the mitigating effects of speed of firm exit and employment flexibility are almost unchanged in terms of sign, size, and statistical significance.

5. The Political Economy of Structural Policy

We have found that flexibility of firm exit and employment can mitigate the adverse effects of shocks. We now use our results to estimate the pay-off to having a structural policy of flexibility as compared with a policy of rigidity. Specifically, we calculate the difference between having a slow speed of firm exit, in which it takes five years to close a business, placing the country at the 10th percentile, and one in which it takes only one year to close a business, placing the country at the 90th percentile. We calculate the discounted net present value of the switch from the less flexible, to the more flexible policy. We assume that each country will continue to experience the frequency and magnitude of shocks that they experienced during our sample period, and will have the same level of commodity exports to GDP, thus arriving at country-specific pay-offs to the hypothetical change in structural policy. For example, Zambia has a commodity exports to GDP ratio of 0.35, an average shock frequency of 0.16 shocks per year, and an average shock size of 0.30 (30 percent). This yields a growth gain of 0.88 percentage point per year.[17] Using a discount rate of three percent, this is equivalent to a one-off increase in current GDP of 29 per cent.[18] This indicates that the difference between flexible and inflexible structural policies can be substantial.

In a well-functioning polity, gains of this order of magnitude from policy change will already have been reaped. That is, we should expect to find a broad correspondence between the size of the gains from flexible structural policies and the actual occurrence of such policies. We now investigate whether resource-rich countries reveal evidence of such polities: do those countries in which flexible policies deliver

[17] Using the estimation results in Table 4, column (1), we estimate the average annual increase in growth from this increased flexibility as the coefficient of the interaction term (1.19), times the increase in flexibility (0.44), times commodity exports to GDP (0.35), times the average size of a shock (0.30) times the average shock frequency (0.16).

[18] The one-off GDP gain equivalent to a future growth gain of 0.88 percentage point per year amounts to (1/0.03) * 0.88 = 29 percent.

the largest GDP gain have more flexibility? We include all countries with commodity exports to GDP ratios above 10 percent other than those which are dependent upon agriculture, since agricultural shocks do not appear to matter much for growth. We run a cross-sectional OLS regression of speed of firm exit on the net present value of gains from speed of firm exit, and control variables from Djankov et al. (2006).[19] Whereas we might hope that the higher present value of the policy of flexibility would significantly increase the speed of firm exit, we find precisely the opposite: the larger the pay-off to flexibility the slower is the actual process of firm exit. The perverse effect is large and highly significant. Figure 1 shows a scatter plot and regression line of actual speed of firm exit[20] against the net present value of gains from having fast firm exit instead of slow firm exit.

Before turning to the political economy puzzle of why the conditions that produce high pay-offs for a policy should also make it less likely to be adopted, we turn to an important implication: there are large unrealized gains from the adoption of flexible structural policies in resource-rich countries. We therefore calculate how much each country would gain from increasing its speed of firm exit from its present level to the that of Singapore, which is the most flexible in the world. Returning to the example of Zambia, the net present value from increasing the speed of firm exit to Singapore's level is equivalent to a one-off gain of 13 percent of one year of GDP. For a very inflexible but highly shock-prone country like Angola, this value is 31 percent of GDP, while countries like Venezuela, Republic of Congo, Nigeria, and Ghana, for example, would gain 16, 10, 7, and 2 percent of GDP, respectively. Although these numbers are just estimations of the pay-off of increased flexibility, their order of

[19] English, French, German, and Scandinavian legal origin, and the log of PPP-adjusted GDP per capita). .
[20] The speed of firm exit variable was multiplied by 100.

magnitude suggests that the inevitable political costs of increasing flexibility would be worth bearing.

We now turn briefly to the deeper question as to why there is a perverse relationship between the gains from flexibility and actual policies. Clearly, it cannot be literally that having a large gain from a policy reduces the chances of its being adopted. Rather, it is more likely that there is something that is correlated with the size of the gain that reduces the responsiveness of policy to opportunity. We do not need to look far to find such a variable. As estimated, the size of the gain from flexibility is directly proportionate to the degree to which the economy is dependent upon non-agricultural resource exports. Societies which have a high share of such exports in GDP will almost inevitably have large resource extraction revenues accruing to the government. In a simple political economy model, Collier and Hoeffler (2008) show that rational, self-interested politicians would respond to high resource revenues by reducing taxation of citizens, thereby reducing the degree to which citizens hold government to account. How might this affect the rules governing flexibility? We might reasonably imagine that all former colonies inherited labour laws and procedures for the closure of firms from their former imperial power, these rules being insensitive to the circumstances of the particular country. Over the past half-century there will have been a gradual adjustment of rules as governments used the power of sovereignty to revise them better to reflect the needs of the society. An implication is that in societies where governments are only weakly accountable to the needs of domestic economic actors, economic policies would be less responsive to the needs of the society, one instance of which would be that these particular rules would be less appropriate.

Collier and Hoeffler confine their empirical tests to the outcome measure of economic growth, but our measure of a specific economic policy is consistent with their results.

If, as we suggest, the problem of perverse political economy is driven by resource rents, we should find no such pattern in respect of the other type of shock we have investigated, namely natural disasters. We therefore repeat the analysis for these shocks. As before, we assume that countries will continue to experience the frequency of natural disasters that they experienced during our sample period. Consider a country like Bangladesh, which suffered from one or more natural disasters in 32 of the 45 years in our sample. Indeed, in some years it suffered multiple shocks, so that in total there were 42 climatic shocks, (mainly floods), two humanitarian shocks, and one geological disaster. We calculate the net present value of an increase in the dummy of employment flexibility from zero (not flexible) to one (flexible). The net present value of employment flexibility amounts to a one-off gain of 27 percent of GDP. This indicates that the gains from employment flexibility can be substantial. For India we estimate a gain of 29 percent of GDP, while for Madagascar, Mozambique, Botswana, Honduras, and Kenya, for example, this value is 21, 20, 14, 12, and 8 percent of GDP, respectively. As before, we now compare these benefits to the actual levels of employment flexibility in these countries. We include all countries with a probability that at least one disaster occurs in a given year that exceeds 0.2. With or without control variables, the coefficient on the net present value of the gains from increased flexibility is virtually zero and highly insignificant. Figure 2 illustrates through a scatter plot and regression line of actual flexibility of employment[21] against the net present value of gains from increased flexibility of employment. Hence, while

[21] We use the continuous variable rather than the dummy variable and multiplied it by 100.

disaster-prone countries are not systematically realizing their opportunities for good policies, there is no sign of a systematically perverse political economy. The problem of dysfunctional structural policies towards shocks lies not in the shocks, but in the resource revenues with which they are associated.

6. Conclusions

At a time when commodity prices are at an all-time high it is wise to consider the consequences should they decline. We have focused on structural policies that are well-suited to mitigating such adverse shocks. The advantage of structural policies is that they do not depend upon a government responding in a timely manner to a price deterioration: structural policies can be put in place at any time prior to an adverse shock and then simply left alone. Specifically, we have investigated those structural policies that affect the speed by which firms can adjust, primarily through hiring or firing labour, and ultimately through the ability to close the firm. We have shown that increased flexibility in these characteristics substantially reduces the cost of adverse shocks.

We then investigated whether governments of shock-prone resource-rich economies actually adopted such policies. We found evidence of a perverse political economy: the circumstances that produced the largest gains from flexibility were also those in which the actual policies adopted were furthest from flexibility. One implication is that in many resource-rich countries there are large, unrealized gains to be had from the adoption of greater flexibility: often a one-off policy reform would be worth in excess of ten percentage points of one year of GDP. We suggested that the reason for

the perversity of the political economy is that resource revenues enable governments to be less responsive to the needs of economic actors and so more inclined to leave in place policies that are economically very costly.

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Table 1a: Summary statistics

	Obs.	Mean	St. Dev.	Min.	Max.
Real GDP per capita (log)	3608	7.54	1.55	4.31	10.55
Trade to GDP	3608	0.64	0.36	0.06	2.51
Inflation (log (1 + inflation rate))	3608	0.14	0.29	-0.24	5.48
Reserves to GDP	3608	0.09	0.10	0.00	1.24
Commodity export price index	3608	0.34	0.36	0.00	1.97
Unlogged unweighted index (1980 = 100)	3608	81.07	26.87	15.10	230.05
Commodity exports to GDP	3608	0.08	0.09	0.00	0.45
Oil import price index	3608	3.11	1.85	0.00	4.96
Δ GDP per capita (log)	3608	0.02	0.05	-0.36	0.30
Δ Trade to GDP	3608	0.01	0.08	-0.88	1.21
Δ Inflation (log (1 + inflation rate))	3608	-0.00	0.19	-3.62	2.52
Δ Reserves to GDP	3608	0.00	0.03	-0.25	0.31
Coup	3608	0.03	0.17	0	2
Civil war	3608	0.07	0.26	0	1
Flexible exchange rate	2907	0.62	0.49	0	1
Aid (log)	2785	1.43	1.00	-0.92	4.38
Financial depth	3324	0.37	0.34	0.00	3.45
Financial openness	3120	-0.03	1.45	-1.77	2.60
Remittances	2442	2.68	6.74	0.00	90.42
Flexibility of employment	3513	0.47	0.50	0	1
Ease of hiring	3513	0.57	0.50	0	1
Ease of firing	3513	0.52	0.50	0	1
Flexibility of hours	3513	0.62	0.49	0	1
Speed of firm exit	3198	0.74	0.17	0	1
Speed of firm entry	3472	0.51	0.14	0.19	1
	Number	Mean	St. Dev.	Min.	Max.
Positive commodity export price shocks (unweighted)	377	0.29	0.17	0.09	1.03
Negative commodity export price shocks (unweighted)	392	0.26	0.14	-0.01	0.81
Natural disasters	688	1.32	0.59	1	4

Table 1b: Commodities

aluminum^n	nickel^n	zinc^n	copra	groundnutoil	Poultry	soybeans	wool
phosphatrock^n	oil^n	bananas	cotton	groundnuts	Pulp	sugar	
copper^n	coal^n	barley	fish	oranges	Rice	sunfloweroil	
gasoline^n	silver^n	butter	maize	palmkerneloil	Rubber	swinemeat	
ironore^n	tin^n	cocoabeans	pepper	palmoil	Sisal	tea	
uranium^n	lead^n	coconutoil	hides	oliveoil	Sorghum	tobacco	
natural gas^n	urea^n	coffee	jute	plywood	Soybeanoil	wheat	

n = non-agricultural commodities

Table 2: Estimation results cointegration model

Long-run coefficients		***Short-run coefficients (cont'd)***	
Trade to GDP	0.462***	Δ Trade to GDP$_{t-1}$	0.018
	(0.132)		(0.015)
Inflation (log)	-0.186**	Δ Inflation (log)$_{t-1}$	-0.00
	(0.077)		(0.00)
Reserves to GDP	0.698***	Coup$_t$	-0.031***
	(0.249)		(0.007)
Commodity export price index	-1.034***	Civil war$_t$	-0.022***
	(0.342)		(0.005)
Oil import price index	-0.114	Positive price shock$_t$	0.049
	(0.083)		(0.076)
Short-run adjustment coefficient		Positive price shock$_{t-1}$	0.085
GDP per capita (log)$_{t-1}$	-0.062***		(0.057)
	(0.008)	Negative price shock$_t$	-0.070
Short-run coefficients			(0.069)
Δ (GDP per capita (log))$_{t-1}$	0.140***	Negative price shock$_{t-1}$	-0.346***
	(0.029)		(0.106)
Δ Reserves to GDP$_{t-1}$	0.055	Natural disaster$_t$	-0.037**
	(0.035)		(0.015)
Number of observations	3608	R-squared within	0.26
Number of countries	129		

Notes: The dependent variable is the first-differenced log of real GDP per capita in year t. All regressions include country fixed effects and regional time dummies. Robust standard errors are clustered by country and are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 3: The effects of negative commodity export price shocks and natural disasters

	(1) comm. exp. price shocks	(2) comm. exp. price shocks	(3) comm. exp. price shocks	(4) comm. exp. price shocks	(5) comm. exp. price shocks	(6) natural disasters	(7) natural disasters	(8) natural disasters	(9) natural disasters	(10) natural disasters
Shock	-0.97***	-0.86**	-0.98***	-0.97***	-0.94***	-0.09	-0.14*	-0.09	-0.10*	-0.11*
	(0.23)	(0.41)	(0.23)	(0.24)	(0.23)	(0.06)	(0.08)	(0.06)	(0.06)	(0.06)
Shock * financial depth		-0.08					0.17			
		(1.08)					(0.13)			
Shock * financial openness			-0.19**					-0.03		
			(0.10)					(0.02)		
Shock * reserves to GDP				-1.36					0.16	
				(1.13)					(0.13)	
Shock * remittances					0.05					0.00
					(0.05)					(0.00)
Shock * flex. exchange rate	0.62***	0.57***	0.56***	0.70***	0.59***	-0.00	0.01	-0.01	-0.00	0.01
	(0.19)	(0.22)	(0.19)	(0.20)	(0.19)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Shock * aid	0.25**	0.22*	0.23*	0.28**	0.21	0.02	0.02	0.01	0.01	0.02
	(0.13)	(0.13)	(0.12)	(0.13)	(0.13)	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
Number of observations	1286	1201	1265	1285	1273	1286	1212	1274	1285	1273
Number of countries	74	72	74	74	72	74	72	74	74	72
R-squared within	0.33	0.34	0.34	0.33	0.34	0.32	0.32	0.32	0.32	0.32

Notes: Table 3 only reports coefficients and standard errors of the variables of interest. The dependent variable is the first-differenced log of real GDP per capita in year t. All regressions include country-specific and time-specific fixed effects. Robust standard errors are clustered by country and are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Columns (1) to (5) report the effects of a negative commodity export price shock at *t-1* on growth at *t*, columns (6) to (10) report the effects of a natural disaster at *t* on growth at *t*. All policy variables refer to the year of the shock.

Table 3: The effects of negative commodity export price shocks and natural disasters (cont'd)

	(11) comm. exp. price shocks	(12) comm. exp. price shocks	(13) comm. exp. price shocks	(14) comm. exp. price shocks	(15) comm. exp. price shocks	(16) natural disasters	(17) natural disasters	(18) natural disasters	(19) natural disasters	(20) natural disasters
Shock	-0.96***	-0.63	-2.25***	-2.42***	-2.73***	-0.15**	-0.16**	-0.14	-0.13	-0.14
	(0.23)	(0.39)	(0.43)	(0.55)	(0.71)	(0.07)	(0.07)	(0.09)	(0.13)	(0.13)
Shock * flex. of employment	0.44**				-0.20	0.10**				0.10**
	(0.21)				(0.28)	(0.04)				(0.04)
Shock * ease of hiring		-0.37					0.12**			
		(0.30)					(0.06)			
Shock * ease of firing		0.61**					0.09*			
		(0.29)					(0.05)			
Shock * flex. of hours		0.27					-0.08			
		(0.31)					(0.06)			
Shock * speed of firm exit			2.43***	2.15**	2.42***			0.12	0.12	0.05
			(0.64)	(0.87)	(0.94)			(0.10)	(0.10)	(0.11)
Shock * speed of firm entry				0.80	1.21				-0.01	-0.03
				(1.64)	(1.78)				(0.24)	(0.24)
Shock * flex. exchange rate	0.34	-0.01	0.12	0.15	0.22	-0.01	0.00	-0.01	-0.01	-0.02
	(0.22)	(0.31)	(0.21)	(0.22)	(0.24)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
Shock * aid	0.22*	0.15	0.18	0.16	0.16	0.03	0.03	-0.00	-0.00	0.00
	(0.12)	(0.13)	(0.12)	(0.12)	(0.12)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Number of observations	1284	1284	1212	1212	1212	1284	1284	1212	1212	1212
Number of countries	73	73	68	68	68	73	73	68	68	68
R-squared within	0.33	0.34	0.38	0.38	0.38	0.32	0.32	0.36	0.36	0.36

Notes: See first part of Table 3 on previous page.

Table 4: Instrumental variables estimation and sensitivity analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	price shocks	price shocks	price shocks	price shocks	price shocks	nat. dis	nat. dis	nat. dis	nat. dis	nat. dis
Shock	-1.14***	-1.14***	-1.20***		-1.18***	-0.07***	-0.07	-0.09***		-0.07***
	(0.38)	(0.34)	(0.38)		(0.40)	(0.02)	(0.05)	(0.03)		(0.02)
Shock * speed of firm exit	1.19**	1.19**	1.32***		1.22**					
	(0.48)	(0.49)	(0.48)		(0.50)					
Shock * flex. of employment						0.08***	0.07	0.11**		0.07**
						(0.03)	(0.08)	(0.04)		(0.03)
Shock non-agri				-1.14***						
				(0.40)						
Shock non-agri * speed of firm exit				1.21**						
				(0.51)						
Shock agri				0.73						
				(1.33)						
Shock agri * speed of firm exit				-1.36						
				(1.88)						
Shock geo									-0.12*	
									(0.07)	
Shock geo * flex. of employment									0.12	
									(0.09)	
Shock clim									-0.07***	
									(0.02)	
Shock clim * flex. of employment									0.09***	
									(0.04)	
Shock hum									0.05	
									(0.10)	
Shock hum * flex. of employment									-0.29	
									(0.18)	
Nr. of observations (R-squared)	3198 (0.30)	3082 (0.29)	3198 (0.30)	3198 (0.30)	3198 (0.25)	3513 (0.26)	2286 (0.39)	3513 (0.26)	3513 (0.27)	3513 (0.22)
Method	FE	FE-IV	FE 5% sh.	FE	FE-ARDL	FE	FE-IV	FE dummy	FE	FE-ARDL

Notes: See first part of Table 3.

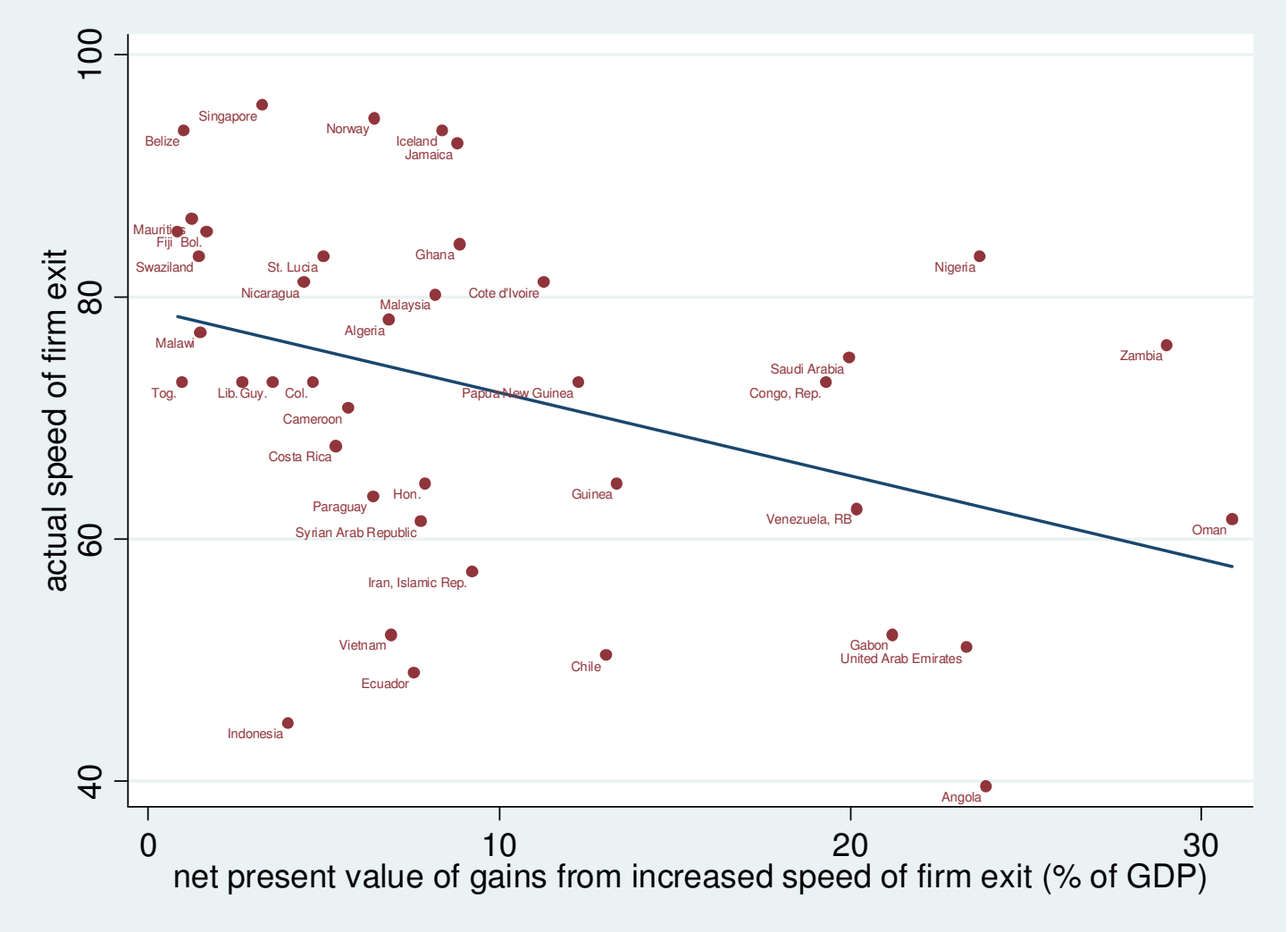

Figure 1: Scatter plot and regression line of speed of firm exit against the net present value of gains from speed of firm exit.

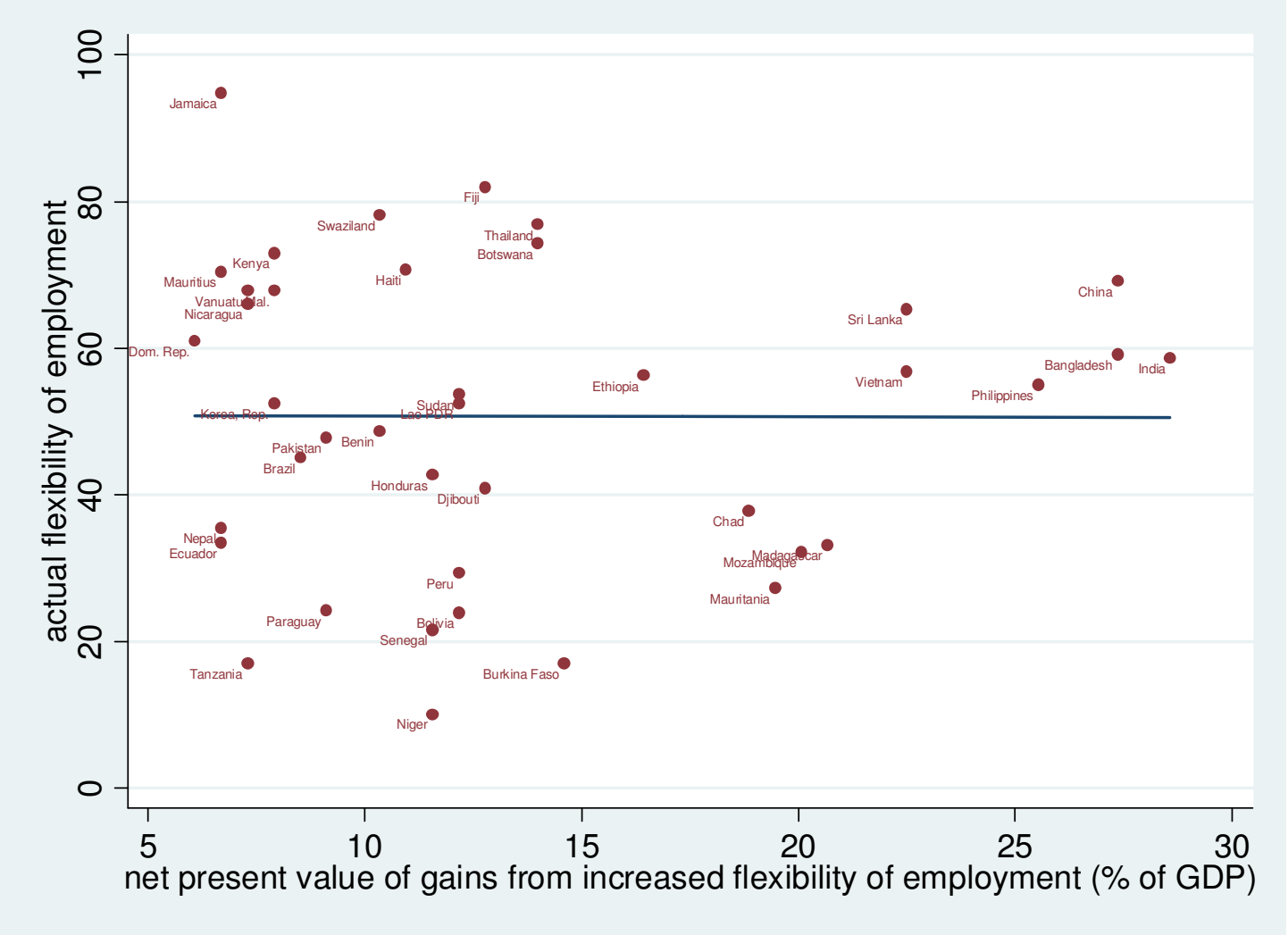

Figure 2: Scatter plot and regression line of flexibility of employment against the net present value of gains from flexibility of employment.

Data appendix

Real GDP per capita in constant 2000 US $ (World Development Indicators (WDI))

Trade openness exports plus imports of goods and services as a share of GDP (WDI).

Inflation log (1 + (annual % change in consumer prices/100)), data from WDI.

International reserves over GDP IFS (1..SZF and AA.ZF) and WDI.

Commodity export price index commodity export values for 1990 from UNCTAD Commodity Yearbook 2000 and UN International Trade Statistics 1993 and 1994. Quarterly world commodity price indices from International Financial Statistics (IFS, series 74 for butter and coal, 76 for all others), except for the natural gas and gasoline indices, which are from the Energy Information Administration (EIA, 2005) (Column (1) in Tables 5.24 and 6.7). Four price series (coal, plywood, silver, and sorghum) had short gaps in the early periods. Following Dehn (2000), we filled these gaps by holding the price constant at the value of the first available observation. Four price series (palmkerneloil, bananas, tobacco, and silver) had 1, 2, or 3 missing values in the middle. These gaps were filled by linear interpolation. Price series with larger gaps were not adjusted. Where gaps for relatively unimportant commodities (share of exports in total exports < 10% or share of exports in GDP < 1%) would cause missing observations, these price series were left out. The geometrically weighted index was first calculated on a quarterly basis and deflated by the export unit value (IFS, series 74..DZF). We then weighted the log of the annual average (rescaled so that 1980 = 100) index by the share of commodity exports in GDP (GDP in current US dollars, WDI). The oil import price index was constructed by interacting the log of the annual average deflated oil price index with a dummy variable for net oil importers. Net oil imports are crude oil imports plus total imports of refined petroleum products minus crude oil exports minus total exports of refined petroleum products (EIA, 2002). Since

these are expressed in thousands of barrels per day, we multiply by 365 times the 2001 mean weekly world oil price per barrel (EIA).

Civil war 1 for civil war, 0 otherwise (Gleditsch, 2004).

Coup d'etat nr. of extraconstitutional or forced changes in the government elite or its control of the nation's power structure (Cross-National Time-Series Data Archive).

Flexible exchange rate dummy based on Reinhart and Rogoff (2004), which takes a value of zero for course classification code = 1, and one for all other categories.

Foreign aid as a % of GNI official development assistance (% of GNI) (OECD IDS).

Financial depth ratio of private credit to GDP from Beck et al. (2000).

Financial openness indicator of capital account openness from Chinn and Ito (2006).

Remittances ratio of transfers by migrants and salaries earned by non-resident workers to GDP (Global Development Finance and WDI).

Flexibility of employment dummy based on rigidity of employment index in World Bank (2007) (average of rigidity of hours and difficulty of hiring and firing).

Ease of hiring dummy based on difficulty of hiring index in World Bank (2007).

Ease of firing dummy based on difficulty of firing index in World Bank (2007).

Flexibility of hours dummy based on rigidity of hours index in World Bank (2007).

Speed of firm exit based on time to close a business (in years) in World Bank (2007).

Speed of firm entry based on time to start a business (in days) in World Bank (2007).

Natural disasters number of large geological, climatic, or human disasters ($\geq 0.5\%$ of population affected, or damage $\geq 0.5\%$ of GDP, or ≥ 1 death per 10000, IMF (2003)). Data are from the WHO Collaborating Centre for Research on the Epidemiology of Disasters (CRED) available at www.em-dat.net. Geological disasters: earthquakes, landslides, volcano eruptions, tidal waves; Climatic disasters: floods, droughts, extreme temperatures, wind storms; Human disasters: famines, epidemics.