TRADING PARTNER VOLATILITY AND THE ABILITY FOR A COUNTRY TO COPE: A PANEL GMM MODEL, 1970-2005
EDWARDS, Jeffrey*

Abstract
This paper explores how six indicators of domestic and global development, influence the dissemination of volatility in trading partner growth rates. Using a dynamic panel, fixed-effects, system GMM methodology, I find that for the most part, developing countries can indeed cushion their economies from fluctuations in trading partner growth by increasing depth and diversification both domestically and globally. On the other hand, I also find that while developed countries seem to already be insulated from such fluctuations, increases in the same variables will actually increase a country's susceptibility to trading partner volatility.

JEL Classification: O110, O160, O190
Keywords: Volatility, Development, Diversification, GMM

1. Introduction
For about the last couple of decades, researchers have been trying to assess the impact that economic development has on volatility in per capita GDP growth rates. The vast majority of this research has focused on financial depth and the ability to spread risk. The intuition is that as a country develops economically, it deepens financially, diversifies industrially, and its agents become savvier; because agents can better diversify risk, there is an increase in an economy's ability to handle shocks. In this era of globalization, however, can a country strike a balance between increased exposure to foreign markets, and at the same time insulate itself from fluctuations in those markets?

The purpose of this paper is to test the dissemination of growth volatility from a country's major trading partners as a function of six different determinants of development. Each of the six determinants used in this study proxy for different facets of financial depth, agent sophistication, sectoral diversification, and global interconnectedness. Three of the determinants proxy for depth, education, and diversification at home, while the other three try to capture a country's global interactions. While the literature is rife with contagion effects across different areas of financial markets, and there is some literature addressing cross-national growth and volatility dissemination, there is little examining spillover specifically of trading partners. And the literature interacting trading partner volatility spillover with any measure of development is practically non-existent. This study intends to start to fill this void.

What this study finds is threefold. First, increasing sectoral diversification and financial depth can have considerable benefits in reducing the impact on a country's volatility from that of its trading partners. But, this is only the case for developing nations. In particular, a developing nation that has more domestic investment, credit to the private sector, foreign direct investment, trade in goods and services, or gross capital flows, will find itself relatively more insulated from fluctuations in its trading partners' economy, than nations with lower levels of these variables. The second finding is that for OECD economies, exactly the opposite is true. Increases in these variables tend

* Dr. Jeffrey A. Edwards, Associate Professor, North Carolina A & T State University, USA. Email: jaedwar2@ncat.edu. Website: http://works.bepress.com/jeffrey_edwards/
to actually increase a country's exposure to its trading partner's volatility. There is perhaps some theoretical explanation for this that mostly hinges on the idea that as economies progress through developmental stages, sectoral concentration decreases, then increases beyond a certain level of development. It could be that developed nations will increasingly expose themselves to trading partner volatility as they further invest in these industries and expose themselves to global markets. But, at this point, this is only a guess, and more work must be done in this area.

The third finding in this study is that increasing a country's level of education, in either the OECD or non-OECD case, actually increases exposure to fluctuations in a trading partners' growth rate. Again, exactly why this is so, is not clear. For all intents and purposes, a more educated populace should also be a more financially savvy populace, and therefore be able to take advantage of diversification opportunities. The likely explanation will probably be different for each developmental group. Yet again, however, this is an area for future exploration.

This paper is set up as follows. Section 2 reviews the literature on the links between economic development and the ability to handle fluctuations in growth. It also lays out the determinants used in the study, and attempts to justify their inclusion. This section will then dissect the channels through which development can cushion volatility, and expose the particular link that I intend to explore. Section 3 lays out the model and data used in this study, while section 4 comments on the results. Section 5 draws a brief conclusion.

2. The Link between Development and Volatility

Domestically, lesser-developed economies are more volatile because of their relatively unsophisticated financial markets and undiversified production sectors. For example, Acemoglu and Zilibotti [1997] argue that weakly developed countries lack a significant number of economic sectors, and therefore lack a facet for diversification. Diversification opportunities, therefore, will increase with domestic investment. As investment increases, so do the number of sectors in the economy, resulting in a greater ability to spread risk. A country that lacks capital stock will see fewer opportunities for diversification, preventing agents from spreading risk as a hedge against shocks. Koren and Tenreyro [2007] show that as the level of development increases, production tends to shift towards less risky sectors, thereby lessening shock susceptibility. One argument for this result is the role played by technological diversification in more developed economies. Firms using a variety of inputs can more effectively mitigate the impact of shocks. Each input matters less to overall production and other inputs can fill in as substitutes.

In the educative arena, economic agents in lesser-developed economies may simply not be as investor-savvy as those in more developed economies. Even if diversification opportunities are present, they may not be fully exploited. Aghion, Banerjee, and Piketty [1999] establish a link between low financial sector development and high volatility. Their model shows that a sharper separation between savers and investors results in greater volatility. One characteristic of an emerging economy may be the lack of the capital, skills, ideas, and connections needed for someone to partake in successful investment opportunities. Large separations between savers and investors, therefore, results in a less robust response to changes in output, and changes that are more persistent. As economies develop, then, incomes and education should increase, and the
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separation between savers and investors should decrease. This should result in a greater ability to address fluctuations in the economy. Education also plays a role when focusing on the differences in labor supply elasticities of skilled and unskilled labor. Kraay and Ventura [2001], show that rich countries have a comparative advantage in sectors that face less elastic product demand and labor supply, and therefore can cope better with macroeconomic shocks. In particular, participation by a more skilled labor force is less likely to be affected by changes in labor demand. Country-specific shocks are therefore magnified in countries using lower-skilled labor.

In all, a country with greater investment, more opportunities to invest, and a more educated populace, should have a greater ability to handle fluctuations in output. Yet another characteristic of development, however, is that economies increasingly open up to global markets.

Global Development and Volatility

As development increases so do global diversification opportunities. The opening of capital accounts to the rest of the world can help a country adjust to shocks by spreading financial risks to a more global setting [Calderon, Loayza, and Schmidt-Hebbel, 2005; Edison et al., 2002]. Bekaert, Harvey, and Lundblad [2006] argue that international risk-sharing is even correlated with lower consumption growth volatility. As long as a country is not too economically fragile and has a decent institutional structure and financial sector, equity market liberalization can reduce real variability.

Trade openness can be beneficial for countries where increases in trade-flows results in greater intra-industry specialization across countries. This would lead to a large volume of intermediate inputs trade resulting in declining volatility [Kose, Prasad, and Terrones, 2003; Razin and Rose, 1994]. Furthermore, as the number of market participants grows, the likelihood that negative shocks from one agent is offset with positive shocks from another increase; and, the greater the number of market participants, the lower is any one agent's proportional contribution to a shock [Down, 2007]. Openness to foreign goods markets can also reduce an economy's vulnerability to some forms of shocks such as sudden stops and currency crashes [Calvo, Izquierdo, and Mejia, 2004; Cavallo, 2005; Cavallo and Frankel, 2004; Cavallo, 2007]; additionally, it will reduce ex post output costs of crises, and experience increasing re-adjustment after a shock [Guidotti, Sturzenegger, and Villar, 2004; Sachs, 1985]. Overall, increased global exposure can increase an economy's ability to handle shocks.

Nevertheless, there is a strong argument that the globalization of an economy's accounts exposes the country to the fickleness of outside investors [Furman and Stiglitz, 1998]. When investors see volatility within a nation, they observe a weakening of firms and institutions, leading them to pull-out their money, thus intensifying the shock [Easterly, Islam, and Stiglitz, 2000]. The most notable evidence of this phenomenon is the ten year period from the early 1990's to about 2004, beginning with economic crisis in Mexico. Many emerging economies during this period suffered from large reversals in capital inflows, followed by deep recessions [Mendoza and Devereux, 2005].

Trade openness can increase volatility exposure in an economy by creating large sectors of production that are more specialized and therefore more vulnerable to shocks—via both import and export markets. Koren and Tenreyro [2007] show that during early stages of development high sectoral concentration tends to accumulate in high risk sectors, magnifying shocks to the economy during these stages. Countries in this stage also disproportionately expose themselves to foreign aggregate demand shocks, as well as
having greater susceptibility to world price fluctuations [Cameron, 1978; Rodrik, 1998; Easterly, Islam, and Stiglitz, 2001]. Economists generally agree that trade openness does increase economic growth; but unlike most determinants of development, it can increase a country’s exposure and vulnerability to external shocks [Kose, Prasad, and Terrones, 2003]. As a result, according to the so-called compensation hypothesis, more open economies tend to have larger governments for the very reason of reducing/reacting to shocks generated by the economic insecurities of being more open [Cameron, 1978; Garrett, 1998; Rodrik, 1998]. (Some, however, have recently disputed this notion empirically [e.g., Kim, 2007; Down, 2007].)

Establishing Tell-Tale Determinants

If one were to model the implications made above, one would have to first determine a set of variables that would proxy as indicators of development, and yet are linked to these findings. The list of financial development and openness indicators used in the literature is huge. But, for this study, it is sufficient to use a limited list of determinants, most of which have been used before in highly-recognized studies investigating similar, but different, phenomena. Internally, gross domestic investment, schooling, and the amount of credit offered to the private sector should be good indicators of domestic economic development.

If increasing levels of gross domestic investment increase growth in an economy, then it should also lead to increased development. Furthermore, greater domestic investment should be an indicator of greater financial deepening and industry diversification [Acemoglu and Zilibotti, 1997]. Insofar as land improvements, equipment purchases, infrastructure improvement, etc., proxy for more sectors in the economy, it should measure the ability for a country to diversify its risk. As long as the domestic investment that is taking place is increasingly diversified, we should find that it would lead to a greater ability to handle shocks.

Secondly, the amount of financial resources provided to the private sector should be a good indicator of development as it is a direct reflection of financial deepening within an economy [Easterly, Islam, and Stiglitz, 2000]. The more loans, securities, trade credits, etc., should reflect a more sophisticated financial structure that would lead to greater investment opportunities. More investment opportunities imply greater ability to spread risk. This should then lead to greater ability at dealing with fluctuations in the economy.

Lastly, increases in the level of schooling within a nation should lead to, and possibly be an indicator of, economic growth and therefore development. Schooling is important because of the discussion above addressing the degree of separation in the sophistication level of savers and investors. Countries with higher levels of schooling should not have as sharp a distinction between savers and investors as other countries, resulting in a greater ability to handle shocks. Increased education should also to some extent proxy for the skill set of the typical worker. As mentioned earlier, more skilled labor tends to respond less frantically to demand shocks than labor that is less skilled. To this extent, a country that has attained a higher overall level of education should be able to handle shocks more effectively.

The most obvious indicators of global development and economic exposure that are common to the literature are the overall level of gross portfolio and other investment capital flows, foreign direct investment, and of course, the level of total trade in goods and services [Easterly, Islam, and Stiglitz, 2000; Kose, Prasad, Terrones, 2003; Calderon, Loayza, and Schmidt-Hebbel, 2005]. As all of these indicators reflect the level of
financial deepening at the global level, but also exposure to foreign markets, the literature review above paints a conflicting picture of the effect these determinants will have on a country's ability to handle shocks. Greater exposure to foreign markets could increase or decrease an economy's ability to adjust and absorb crises.

The Focus of the Paper

These indicators of development, given the heretofore arguments, can be separated into two groups--domestic and foreign. In the first type, domestic investment, credit to the private sector, and education both produce, and are a reflection of, development, sophistication, and diversification; all of these indicators, to some extent at least, are generated within the domestic economy and political structure. The second type, total trade, gross capital flows, and foreign direct investment, are those forces that are a reflection of a country's interaction with foreign agents.

Growth volatility itself can be separated into two types. One type is volatility that is generated by foreign actors, or by domestic actors responding to changes in foreign events. The other type of volatility is that generated solely by domestic agents responding to changes in the domestic environment. The working hypothesis that falls out of the discussions, then, can be shown diagrammatically as

**Domestic Indicators**
- + Domestic Investment
- + Schooling
- + Credit to Private Sector

**Greater Ability to Handle Domestic Volatility**

**Foreign Indicators**
- + Foreign Direct Investment
- + Gross Capital Flows
- + Openness to Foreign Trade

**Greater Ability to Handle Foreign Volatility**

On the left-hand-side, we have domestic and foreign indicators of development. Positive changes in these indicators then flow to greater ability to handle domestic volatility, and a greater ability to handle economic fluctuations that occur as a result of foreign influences. As previously theorized, positive changes in the domestic indicators should lead to positive changes in the economy's ability to handle all shocks. On the other hand, positive changes in the foreign indicators can lead to either a greater or lesser ability to handle fluctuations in growth.

The type of volatility that is of particular interest in this study is that part of a country's volatility that is caused by their *major trading partner*. Volatility spillovers of this sort are becoming increasingly important especially since the start of globalization in late 1980's and early 1990's. At question is whether a country can maintain and/or increase its exposure to foreign markets, and yet at the same time, insulate itself from fluctuations in those markets. While there are many facets of volatility dissemination from foreigners, the focus here will be on a relatively uninvestigated source--that of the volatility in per capita real GDP growth rates of a country's major trading partners. Hence, the part of the flow diagram that is relevant for this paper is
The work of Calderon, Loayza, and Schmidt-Hebbel [2005], begin to explore these linkages by regressing growth volatility on an interaction with trade openness and proportionately weighted volatility in the growth rates of a country's trading partners. Using a system GMM method to control for endogeneity, they find that the marginal effect of a trading partner's volatility on a country's level of volatility increases as an economy opens up to trade. They also find that financial openness tends to decrease the spillover from trading partner volatility---although they use a different variable for financial openness in this particular instance than what is used in this paper. In other words, what they found in the context of the flow diagram above, the bottom path in the flow chart would have a positive sign for one variable, and a negative sign for another.

While their paper is a very intelligent start to addressing this sort of relationship, the comprehensiveness of their model design prevents them from capturing the full effect of development on the relationship with trading partner volatility. First, in the regressions of interest, i.e. that of Table 7 in their paper, they control for time-specific heterogeneity, by including fixed-time dummy variables in their estimations. The problem using these fixed-time effects as controls in this case is that it could actually be capturing the adjustment process that the openness variables are meaning to capture. In other words, it could be subtracting-out exactly the effect of interest. To justify this intuition, all one has to do is assume that the process of adjusting to foreign shocks does not necessarily follow a smooth adjustment path. Discontinuity in foreign shock adjustment may result as firms abruptly cutoff production while gradually depleting inventories in the face of an abrupt drop in foreign demand. But, it is this adjustment that is meaning to be studied in this context. Furthermore, the coefficient estimates of these variables show a definite cyclical structure that may be captured better by using lagged dependent variables, while a deterministic trend can be added to control for over growth or decline in volatility. Neither lagged dependent variables nor deterministic trends will conflict with a contemporaneous adjustment process. Another potential conflict between the results in their paper and their assessment is the fact that their other control variables in the regressions are other volatility accounting variables, such as inflation volatility. If such volatility is result of the mechanisms through which a country either increases or decreases their ability to handle foreign shocks, say through monetary policy, then subtracting it out of overall volatility makes interpretation of the intended effect problematic.

Using the same GMM methodology with a more specialized model and data design, I re-investigate their finding, as well as investigate the other five relationships.
Specifically, using an annualized volatility measure, a dynamic panel model to control for dependencies in volatility, a 2SLS system GMM method to control for endogeneity, limiting my trading partner data to only the top ten trading partners in order to enhance the degree of effect, and separating the effects across OECD/non-OECD lines, I explore the marginal effects of the interaction of each of the six determinants above with the top trading partners’ volatility.

3. The Model and Data

The purpose of this paper is to estimate the effects of a country's gross domestic investment, schooling, credit to the private sector, trade openness, foreign direct investment, and gross capital flows, on the relationship between a country's level of volatility in real per capita GDP growth rates and that country's trading partners' growth volatility. The first issue to address, then, is what forms the volatility variables will take. In most studies, the standard deviation of growth is used. Of course, this is calculated by choosing some ad hoc time interval and taking the standard deviation of growth rates over that interval. But, doing so greatly reduces the number of observations and washes-out much of the temporal dynamics, and therefore information, contained in the data.

I intend to follow the example of Edwards, Thames, and Edwards [2006], and Edwards [2007] by using the absolute value of the annual deviation from average growth as a proxy for levels of volatility. These are essentially annual deviations from what could loosely be considered long-run growth. I use the same specification for trading partner volatility as well; but only use the trade-weighted volatility of the top ten trading partners for each country. Using only the top ten trading partners should enhance any correlation with the dependent variable especially for developing nations as many of them disproportionately depend on just a few economies for the bulk of their trade. The trading partner data is from the Direction of Trade Statistics Database from the IMF and covers the years 1980 to 2006. The construction of the remaining variables follows the industry standard.

- Gross domestic investment as a fraction of GDP (GDI),
- Credit to the private sector as a fraction of GDP (CPS),
- The sum of imports and exports as a fraction of GDP (Trade),
- Net inflows of foreign direct investment as a fraction of GDP (FDI),
- Gross private capital flows as a fraction of GDP (GCF),

They are all from the World Development Indicators database issued by the World Bank, and cover the years 1970 to 2005. The schooling variable I choose to use comes from Barro and Lee's data [2000], and covers the years 1960 to 2005 at five year intervals, remaining constant within those intervals. The variable description is average years of schooling. In sum, the relevant data used in this analysis spans the period 1980 to 2005.

The model specification tries to control for most misspecification problems associated with this sort of cross-country analysis. The general functional form will be a fixed-effects model

\[
\text{Volatility}_{it} = a_0 + a_1 \text{Volatility}_{it-1} + a_2 X_{it} + a_3 \text{Volatility}_{jt} + a_4 X_{it} \times \text{Volatility}_{jt} + a_5 \text{trend}_i + e_{it}
\]  

(1)
In (1), Volatility\(_{it}\) is growth volatility in country \(i\) in year \(t\). The variables \(X_{it}\) are the RHS domestic and foreign indicators described earlier; each for country \(i\) in year \(t\). Volatility\(_{jt}\) is the volatility in growth rates for the top ten trading partners, \(j\), in year \(t\); and \(X_{it} * \text{Volatility}_{jt}\) is the interaction between the RHS indicators and trading partners’ volatility.

The interesting analyses, then, lie in testing the following condition(s) \( \frac{\partial \text{Volatility}_{it}}{\partial \text{Volatility}_{jt}} \hat{\alpha}_3 + \hat{\alpha}_4 X_{it} = 0 \). The statistical significance of the marginal effect is calculated based on a 90% confidence interval as a function of the standard error, \( \hat{\sigma}_{\frac{\partial \text{Volatility}_{it}}{\partial \text{Volatility}_{jt}}} = \sqrt{\text{var}(\hat{\alpha}_3) + X_{it}^2 \text{var}(\hat{\alpha}_4) + 2X_{it} \text{cov}(\hat{\alpha}_3, \hat{\alpha}_4)} \).

This model is a fairly standard dynamic panel model with country-specific fixed effects; however, there are some specification issues to deal with -- (1) endogeneity of the RHS variables including the lagged dependent variable, and (2) developmental heterogeneity. Addressing the former, I choose to use a two-stage-least-squares (2SLS) system that incorporates a system GMM method in the first-stage to generate the estimated forms for use in the second stage. The estimates are constructed from their respective lags, as well as deterministic trends. Take, for example, the regression \( \text{Volatility}_{it} = \alpha_{i0} + \alpha_1 \text{Volatility}_{it-1} + \omega_{it} \). A within estimation takes the first difference of the equation to wipe out the \( \alpha_{i0} \)'s. This leaves \( \text{Volatility}_{it} - \text{Volatility}_{it-1} = \alpha_1(\text{Volatility}_{it-1} - \text{Volatility}_{it-2}) + (\omega_{it} - \omega_{it-1}) \).

The problem here is that the term \((\text{Volatility}_{it-1} - \text{Volatility}_{it-2})\) is correlated with \((\omega_{it} - \omega_{it-1})\). Anderson and Hsiao [1981] recommend using Volatility\(_{it-2}\) or \((\text{Volatility}_{it-2} - \text{Volatility}_{it-3})\) as instruments for \((\text{Volatility}_{it-1} - \text{Volatility}_{it-2})\). Arellano and Bond [1991] proposed using the former in a GMM methodology that could start at time period zero. This makes use of a larger number of moments and is sometimes called a difference GMM method. Arellano and Bover [1995] extend this for a highly persistent series whereby the series is differenced and estimated using levels as instruments, as well as a levels series estimated using differences as instruments; this is the system GMM [Blundell and Bond, 1998]. The instrumentation for the other determinants is just as simple, but shifted one period because it is the contemporaneous values that must be estimated in the first-stage, not the lagged values. Hence, the lag structure used in the system for the lagged dependent variable starts with its own first lag, and starts with the second lag for the other determinants. I did not feel the need to instrument Schooling because this variable is only available on 5-year intervals, making it possible to use the prior 5 year point value for the current 5-year annual panel.

It is well understood that this method can quickly gain in the number of instruments, and therefore lead to highly biased results [Windmeijer, 2005]. One of the most frustrating uses of this method, in fact, is that researchers often do not take this into account [Roodman, 2007]. Obviously, over-fitting can be a major problem. Therefore, I will take suggestions from Roodman [2007] to restrict the number of instruments to less
than the number of groups. The first restriction will be in the number of lags that this method uses in the first-stage. Even though 25 years of data are available, I will only let the model exploit the last 10. Furthermore, I collapse the instrument matrix from a diagonal to a column vector. In other words, the instrument set contains only one instrument for each lag distance and instrumenting variable. Two-step GMM estimators can also have significant downward bias. I, therefore, use Windmeijer's [2005] finite sample correction to the weighting matrix. To make sure the errors are independent of the RHS variables, a Hansen test [1982] is performed under the null of the joint independence of the instrument set to the errors. Also performed is an Arellano-Bond test for second-order serial correlation; first-order is expected because of the design of the method.

With regard to issue (2), the issue of developmental heterogeneity, each of the discussions in the introduction tends to imply a non-linear, developmental effect in the relationship between a trading partners' level of volatility, and a country's ability to adjust. Since each stage of the process of economic development is far more important for a country like Nigeria, than it is for say, the United States, it is rational to believe that the changes in the ability to address shocks would be different for each. Therefore, I dichotomize the results along OECD lines.

Making this distinction, however, could very well change our priors made above. Each of the discussions of the correlation between the indicators and a country's ability to handle shocks necessarily applies to developing nations. Developed nations may or may not have the same outcomes. But this begs the question. If a nation is already relatively developed, will further changes in, say, investment necessarily increase one's ability to handle shocks?

There are actually three possible answers to this question--yes, no, and depends. Koren and Tenreyro [2007] recognize the problem with linearizing the effects of development on volatility. As argued by others, and mentioned earlier in this paper, less-developed economies tend to have high sectoral concentration which implies less diversification and therefore less ability to address fluctuations in growth determinants. As economies develop, industry concentration falls, and diversification increases. On the other hand, Koren and Tenreyro find that at latter stages of development, sectoral concentration again increases; but, this has no effect on volatility proper because the concentration tends to occur in low-volatility sectors. Having said this, it does not address a country's ability to handle foreign volatility. It could be the case that further development as indicated by the six variables investigated in this study, leads to reduced ability to handle foreign shocks. This would especially true if this development leads to further economic dependency in these concentrated sectors, even though the industries themselves are not very volatile. Hence, it could be the case for developed nations that we actually get a positive estimate of $\hat{a}_4$.

4. The Results
I start by evaluating the coefficient estimates for each of the models. The first column of Table 1 below lists the respective variables used in each regression, while across the top lists the acronyms of each X that is investigated. The first column lists results with no X’s, i.e., the basic model, while the subsequent columns list output for each X--GDI, School, CPS, Trade, FDI, and GCF, respectively. The point of including the basic model is to determine exactly how much spillover, if any, actually comes from major trading partners. The top set of results pertains to OECD countries, while the bottom set pertains
to non-OECD countries. In the bottom row, one will find the chi-square p-value of overall model fit, the number of observations, countries, and instruments used in the first-stage, for each regression. Under these are the p-value of the Hansen test under the null that the residuals and RHS variables are uncorrelated, and the Arellano-Bond p-value under the null that the residuals exhibit no second-order serial correlation. The results in Table 1 indicate that for the most part, volatility has an autoregressive process for OECD countries with lagged volatility being significant in five of the seven cases. There is a more robust AR process for non-OECD countries with lagged volatility being significant in every case.

Table 1: Fixed-effect, system GMM results

<table>
<thead>
<tr>
<th></th>
<th>Basic</th>
<th>GDI</th>
<th>School</th>
<th>CPS</th>
<th>Open</th>
<th>FDI</th>
<th>GCF</th>
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<tbody>
<tr>
<td><strong>OECD</strong></td>
<td></td>
<td></td>
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<tr>
<td>Volatility_{it-1}</td>
<td>0.123 *</td>
<td>0.142 **</td>
<td>0.145 **</td>
<td>0.137 **</td>
<td>0.014</td>
<td>0.145 **</td>
<td>0.078</td>
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<td></td>
<td>(0.092)</td>
<td>(0.028)</td>
<td>(0.020)</td>
<td>(0.016)</td>
<td>(0.105)</td>
<td>(0.026)</td>
<td>(0.446)</td>
</tr>
<tr>
<td>X_{it}</td>
<td>0.033</td>
<td>-0.986 **</td>
<td>-0.006</td>
<td>-0.002</td>
<td>0.002</td>
<td>-0.245</td>
<td>-0.017 *</td>
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<td></td>
<td>(0.678)</td>
<td>(0.005)</td>
<td>(0.112)</td>
<td>(0.839)</td>
<td>(0.203)</td>
<td>(0.203)</td>
<td>(0.090)</td>
</tr>
<tr>
<td>Volatility_{jt}</td>
<td>0.016</td>
<td>-0.129</td>
<td>-0.625</td>
<td>-0.239</td>
<td>-0.625</td>
<td>-0.625</td>
<td>-0.068</td>
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<tr>
<td></td>
<td>(0.955)</td>
<td>(0.000)</td>
<td>(0.254)</td>
<td>(0.471)</td>
<td>(0.787)</td>
<td>(0.787)</td>
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<tr>
<td>X_{it} \times Vol_{jt}</td>
<td>0.027</td>
<td>0.301 **</td>
<td>0.008</td>
<td>0.015 **</td>
<td>0.299</td>
<td>0.023 *</td>
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<tr>
<td></td>
<td>(0.606)</td>
<td>(0.000)</td>
<td>(0.077)</td>
<td>(0.076)</td>
<td>(0.105)</td>
<td>(0.052)</td>
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<td><strong>Non-OECD</strong></td>
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<tr>
<td>Volatility_{it-1}</td>
<td>0.229 **</td>
<td>0.241 **</td>
<td>0.222 **</td>
<td>0.233 **</td>
<td>0.225 **</td>
<td>0.248 **</td>
<td>0.241 **</td>
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<td>(0.000)</td>
<td>(0.000)</td>
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<td>(0.000)</td>
<td>(0.000)</td>
</tr>
<tr>
<td>X_{it}</td>
<td>0.083</td>
<td>-1.659 **</td>
<td>0.001 **</td>
<td>0.012</td>
<td>0.078</td>
<td>0.007</td>
<td></td>
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<tr>
<td></td>
<td>(0.342)</td>
<td>(0.003)</td>
<td>(0.233)</td>
<td>(0.604)</td>
<td>(0.481)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volatility_{jt}</td>
<td>0.556 **</td>
<td>1.535 *</td>
<td>-0.694</td>
<td>0.480 **</td>
<td>0.969 **</td>
<td>0.482</td>
<td>0.449 *</td>
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<tr>
<td></td>
<td>(0.030)</td>
<td>(0.091)</td>
<td>(0.201)</td>
<td>(0.010)</td>
<td>(0.137)</td>
<td>(0.137)</td>
<td>(0.055)</td>
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<td>X_{it} \times Vol_{jt}</td>
<td>-0.047</td>
<td>0.216 **</td>
<td>-0.0044 **</td>
<td>-0.007</td>
<td>-0.125</td>
<td>-0.125</td>
<td>0.001</td>
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<tr>
<td></td>
<td>(0.252)</td>
<td>(0.033)</td>
<td>(0.001)</td>
<td>(0.155)</td>
<td>(0.275)</td>
<td>(0.275)</td>
<td>(0.631)</td>
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<tr>
<td>Constant</td>
<td>1.636 **</td>
<td>-0.271</td>
<td>8.646 **</td>
<td>1.773 **</td>
<td>0.995</td>
<td>1.815 **</td>
<td>1.637 **</td>
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<tr>
<td></td>
<td>(0.003)</td>
<td>(0.884)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.200)</td>
<td>(0.011)</td>
<td>(0.000)</td>
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<td>Chi^2 P-value</td>
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<td>0.000</td>
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<td>2063</td>
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<td>93</td>
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<tr>
<td>Hansen</td>
<td>0.470</td>
<td>0.386</td>
<td>0.730</td>
<td>0.462</td>
<td>0.275</td>
<td>0.235</td>
<td>0.350</td>
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<tr>
<td>A-B</td>
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<td>0.808</td>
<td>0.984</td>
<td>0.885</td>
<td>0.959</td>
<td>0.735</td>
<td>0.877</td>
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All regressions, including the instruments, include a deterministic trend. * indicates significance at 10%, ** at 5%.

From the Basic regression, we find that OECD countries tend not to experience a statistically significant amount of spillover from their major trading partners. In fact, even considering the magnitude of the coefficient, and ignoring its significance, less than 2%
of trading partner volatility spills over to OECD countries. Having said this, one must be cautious about the OECD outcome. Insignificance may not be an indicator that there is not spillover. It could be that forces that diversify and absorb trading partner volatility are at such a sophisticated level, that they successfully cushion the dissemination of volatility. On the other hand, there is far more spillover to non-OECD countries. Not only does major trading partner volatility spillover in a statistically significant fashion, but over one-half of each percentage point of trading partner volatility disseminates to the country of interest.

As for the other columns listing output from the inclusion/interaction of the other determinants, GDI, School, CPS, Trade, FDI, and GCF, a few interesting details emerge. First, the majority of the statistically significant X's and interactions occur for the School and CPS regressions. What this means is not exactly clear, except that these could be more important determinants for estimating spillover than the others. The second observation for these results lies in the fact that lagged volatility for the OECD countries is insignificant in the Trade and GCF regressions. This may indicate that much of the cyclical effect in volatility for these countries comes in the form of fluctuations in trade and changes in international portfolios. Regardless, none of these observations/curiosities are important for this paper. In fact, there is not much to say here except that trading partner volatility seems to have a statistically significant effect on non-OECD nations, and not on OECD countries. The plots below may shed some additional light on this output.

The figures below depict the marginal effects of trading partner volatility spillover as a function of each of the six X's. Figure 1 plots these effects for non-OECD countries, and Figure 2 for OECD countries. The vertical axes list the magnitude of the effect itself, while the horizontal axes list the magnitudes of the X's. The range of each X axis is particular to the relevant range for each country-type. For instance, FDI as a fraction of GDP ranges from about -10 to 30 for OECD nations, and from about -40 to 40 for developing nations--the horizontal axis for each reflects this difference. Equalizing the axis range across the two country groups would give a false impression of the particular dynamics that underlie the relationships within each country-type.

The plots of the marginal effects in Figure 1 tell a very interesting story. For the most part, the theories put forth earlier hold true. The idea that increasing domestic investment, credit availability to the private sector, and spreading risk to a more global setting by allowing for more trade and greater foreign direct investment, will lower susceptibility to trading partner volatility, does ring true. Specifically, non-OECD nations that have low levels of domestic investment will see statistically significant volatility spillovers from major trading partners. By increasing domestic investment, they can better insulate themselves from these shocks. The same holds true for countries that have larger private sector credit markets, and countries that do more trade in goods and services. By expanding such credit, and opening up to greater trade flows, the susceptibility to fluctuations in foreign economies decreases.

There is also some marginal evidence that opening up to global financial markets can achieve the same goal. Although opening up to greater gross capital flows does not mean an actual decline in the mean of the marginal effect of trading partner volatility, it does
mean a country will see an increase in the margin of error for such an effect. Essentially, this implies that an increase in gross capital flows could actually lead to less of a spillover effect, with a wide degree of caution. Even increases in foreign direct investment can lead to less foreign volatility susceptibility—even though foreign direct investment is never a significant influence on volatility dissemination. The only puzzle here is increases in schooling. Non-OECD countries with relatively high levels of secondary education tend to be more susceptible to trading partner volatility than nations with a less educated population.

Figure 1: Plots of Marginal Effects for Non-OECD Countries

What this means is not exactly clear. According to the theories above, a more educated population should result in less separation between savers and investors, and a more skilled labor force. Both of which should result in a greater ability to handle economic fluctuations. Pure speculation could suggest two reasons for this contradictory outcome. One could be that a more skilled labor force, and more educated savers, could
lead to more entrepreneurship. If these start-up enterprises are relatively small, they would naturally make the economy as a whole, more susceptible to foreign shocks. Another reason could be that a more educated population in a developing nation with not much infrastructure to support it could experience an emigration of this labor to other countries—countries where their talents can be more efficiently exploited for greater gain. To this end, the labor force that remains in the country would necessarily be less skilled; if this were the case, there would be an increase in the separation between savers and investors in such a nation. Such a brain-drain is not uncommon in many countries.

In all, it appears as though non-OECD countries can gain by developing both domestically and internationally. This gain would be seen by a reduction in the country's exposure to fluctuations in foreign economies; specifically, the economies that are directly linked through trade. We do, however, see a much different picture for OECD countries. Figure 2 below depicts the same plots as Figure 1, but only for OECD nations.

Figure 2: Plots of Marginal Effects for OECD Countries
For OECD countries, the marginal effect is upward sloping in every case. Combined with the fact that the origin of the marginal effect is insignificant in almost every case, implies that these countries have probably already reached a level of development whereby trading partner shocks have no real effect on their economies. In other words, it could be the case that their ability to handle this type of foreign shock is at a maximum. But, increasing the size and sophistication of domestic credit and investment, and further exposure to foreign markets results in a reduced ability to handle these shocks. In fact, in five of the six cases, further increases in the development determinants results in a statistically significant amount of trading partner volatility spillover.

Reconciling this result with the fact that we saw no significant spillover in the Basic model, it must then be the case that something else in these economies are providing insulation from foreign growth volatility. What this is is an area for future research. But, the idea that OECD economies can further insulate themselves from exposure to fluctuations in their trading economies by developing even further, and increasingly diversifying themselves globally, is not accurate. Further development will only increase this exposure, and decrease their ability to handle shocks emanating from trading partners.

Interestingly, in both cases, the image that stands out the most is that of schooling. It seems that whether you reside in an OECD or non-OECD country, educating your population will increase exposure and lower your country's ability to handle trading partner volatility. The ad-hoc and possibly flimsy argument given earlier for non-OECD countries hinged on two areas. The first was based on the idea that a more educated population leads to more small-scale entrepreneurship which then leads to more susceptibility to volatility. The other argument hinged on a lack of infrastructure in an economy needed to keep an educated population employed at wages that reflect their skill levels. As these workers leave the country, what is left is necessarily a less skilled labor force, and larger separation between savers and investors. Both of which will lead to more exposure to foreign volatility. Neither argument, however, would hold water for a relatively developed, OECD country. The finding for OECD countries, I will relinquish for future research.

In sum, the idea that opening oneself to the global economy, increasing domestic credit market sophistication, and global diversification, leads to a greater ability to handle foreign shocks seems to be true—but only for developing nations. But, beyond a certain level of sophistication, a level which in our case results in acceptance to the OECD group of countries, increasing domestic market sophistication and global exposure actually increase a country's susceptibility to handle shocks.

5. Conclusion
The conclusions in this study are threefold. First, I found that domestic development in terms of increased gross domestic investment and credit to the private sector, and international development in terms of increased trade, and to a lesser extent foreign direct investment and gross capital flows, does indeed lead to less susceptibility to fluctuations in a trading partner's economy for developing nations. On the other hand, increasing these same factors for OECD countries will increase a country's exposure to such shocks.
The former finding is important because it was also shown that there is a statistically significant, and rather large, spillover of foreign volatility to developing nations. Therefore, the findings in this paper suggest that these countries can reduce this spillover by developing domestically and globally. The latter finding is less important simply because it was also shown that there is not a significant amount of spillover occurring to developed nations. In other words, they are currently doing a good job of cushioning themselves against fluctuations in trading partner growth. However, combined with the findings of each of the development variables which should increase susceptibility, it must mean that there is something else in these economies that make the insulator effect possible—an area of future research.

The third finding of interest is the fact that regardless of the country-type, a more educated population results in a lesser ability to handle fluctuations in trade-related economies. Pure speculation suggests that for developing nations, there is either an increase in small-scale entrepreneurial exposure, or an increase in skilled labor emigration—either one leading to less cushioning of foreign shocks. Whether this is accurate or not is an area of future research; but so is the reasoning behind the OECD schooling result which is well beyond the scope of this paper.

To this end, this paper shows that if a trading partner does disseminate their volatility to developing nations, they will have the ability to cope.

References


