Dissertation Summary/Job Market Paper

Trade Openness and Economic Growth: System GMM Estimate and Panel Vector Autoregression Analysis with Difference-in-Difference Combining Instruments for a Dynamic Panel Dataset of North American Countries

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My dissertation investigates empirically the notion that trade openness resulting from deregulation and reduced tariffs required by the North America Free Trade Agreement (NAFTA)

promotes the acceleration of economic growth. Methodologically, I employ a two-step instrumental variable (IV) method in which NAFTA adoption is considered as an instrumental variable for trade openness. I use the difference-in-difference (DID) captured by NAFTA adoption in the first step and in the second step I take system generalized method of moments(GMM) and Panel Vector Autoregression (VAR) to estimate a dynamic panel dataset. The combination of IV and DID (DDIV) minimizes the negative impact of omitted variables. Therefore, in theory DDIV can improve estimate significance. My dissertation has some creativity. First, I try to combine difference in difference with instrumental variable. I introduce DID in the first step of IV. Second, I make a system GMM with DDIV in a dynamic panel dataset to analyze the effect of trade openness in GDP growth. The previous papers researching international trade did not use such a complex econometric method.

Regarding to my data of each variable, real GDP annual growth rate and GDP per capita data from 1980 to 2016 are from the World Economic Outlook (WEO) dataset of the International Monetary Fund (IMF). Trade openness from 1980 to 1996 is captured by international trade value percentage (ITVP) of GDP each year, which can be found in World Bank Dataset. Physical capital growth corresponds exactly to gross capital formation growth rate. Gross capital formation growth rate from 1980 to 2016 is also from World Bank (WB) dataset. Expected mean years of schooling from 1980 to 2016 is from the UNESCO Institute for Statistics 2017 in the United Nations. Population annual growth rate data across countries derived from the total population of each country are downloaded from the World Bank (WB) dataset website. Though five-year average data is used often in growth estimates to minimize cyclical effects, in this dissertation I use annual data. First, this dissertation will make a large amount of time series analysis. The pre-requisite condition of time series analysis is that data should be stationary. My dataset covers 36 years. If I use six-year average data, the data of each variable in time series would be non-stationary. Besides, using average data over several of years creates some “jumps” between groups of data in different periods, which lead to a problem of discontinuity. Moreover, before making a series of regressions, I run a dynamic panel unit root test and according to its results to make necessary differences for data of each variable. After differencing, all the transformed annual data removes time trend and keep stationary. In this procedure, cyclical fluctuation will be eliminated.

Empirically I first try to demonstrate the effectiveness of DDIV. First, I make a couple of

serial correlation tests to decide that the predetermined terms should be added into each variable. Then I make a panel data heteroskedastic test and the result shows heteroskedasticity exists so I need to use GMM or GLS estimate. Moreover, I used a series of dynamic panel data unit root tests to make all the data stationary by differencing. After completing all the tests, I first make a system GMM estimate without DDIV and the results show the positive effect of trade openness in GDP growth in simultaneous time.

Besides, I make a system GMM with DDIV. First, I run a Hausman test to determine random effect should be added into my model. Then, I set up a test for the parallel assumptions for DID and verify that the control group and benefit group share a common trend. On the other hand, I use the Arellano estimator to test the endogeneity of IV. The results do not give support for the endogeneity of IV. Therefore, DDIV might be a practicable method for system GMM estimator in a dynamic panel dataset.

Moreover, I compare system GMM estimator without DDIV and system GMM estimator with DDIV, both of which display similar conclusions: trade openness at time t is positively relative to current GDP growth at time t whereas the lagged trade openness at time t-1 is negatively related to current GDP growth at time t. Also, we can find the coefficient estimator by system GMM with DDIV has a smaller p-value, which implies the possibility of modeling significance. Notwithstanding, we do not find a narrower range of most of the robust standard errors. Let us move on to DDIV itself. The coefficient estimate of DID is negative without statistical significance. We do not find cogent evidence to support the conclusion that joining in NAFTA promotes or obstructs the growth of trade percentage of GDP.

Regarding the effect of trade openness on GDP growth rate, the system GMM estimator with DDIV, system GMM estimator without DDIV, and panel VAR analysis reach a consensus that trade openness at time t has a positive effect on GDP growth rate at the current time t, whereas the lagged trade openness at time t-1 has a negative effect on GDP growth rate. The results from system GMM with DDIV demonstrate that a positive increase in trade openness at current time t will raise the GDP growth rate at current time t by 0.08 percentage points while a positive increase in lagged trade openness at time t-1 will reduce the GDP growth rate at current time t by 0.01 percentage points. Such an effect will die out after five years.

Furthermore, I set up a panel Vector Autoregression (VAR) Model with DDIV and use the

IV-GMM two stage method to estimate the model. That is to say, I still use NAFTA adoption as instrumental variable and employ DID in the first step. In the second step I employ panel VAR model to estimate the effect of trade openness on economic growth. Panel VAR has the consistent results as system GMM with DDIV. Panel VAR results also show the positive effect of GDP growth in trade openness.

Additionally, I make an estimate for the effect of a shock to trade openness on GDP growth within each of the member countries of NAFTA and between member countries of NAFTA, which obtains diverse results. First, I conduct a VAR analysis for each member country of NAFTA. Then I conduct a series of Granger-causality tests which reveal that there are two granger causality relationships across the member countries of NAFTA: First, the Canada and Mexico GDP growth rates Granger-causes the US GDP growth rate. Second, the Mexico and US GDP growth rates Granger-causes the Canada GDP growth rate. On the basis of VAR analysis of each member country and Granger-causality across member countries, I calculate the effect of a trade openness shock happening one of the countries on the GDP growth rate of the other countries. The results are mixed. First, the effect of the increase of Mexico's trade openness in United States and Canada GDP is tiny negative initially and then turns to be positive. On the other hand, the effect of the increase of Canada's trade openness in US GDP is positive. For example, a positive shock to Canada trade openness will increase the US GDP rate by 0.99 percentage points, whereas a positive shock to Mexico trade openness would drop US GDP rate by negative 0.0067 points at step 1. According to the results, we can make some reasonable conjectures. NAFTA eliminates the barriers between member countries. Due to lower production cost, Mexico's products are competitive and hence exports to United States and Canada increase. In order to tackle the challenge, some firms in United States and Canada move their product lines to Mexico to get lower costs, which has a negative effect in their GDPs in the short run.

Eventually, I compare the empirical results from system GMM with DDIV and panel VAR with DDIV to the results achieved from the previous researches about the relationship between trade openness and economic growth. First, our empirical results from the dynamic system GMM with DDIV show a positive effect of trade openness in GDP growth at the simultaneous period, which is accordance with the results from the mainstream of researches. Second, the dynamic system GMM with DDIV shows the effect of trade openness in GDP will die out in around five years, which supports the results by Hilojosa and Robinson (1992).Third, the results

from panel VAR with DDIV shows one percentage point increase in GDP growth rate at time t-1 will increase trade percentage of GDP at time t by 0.67 percentage points, which implies GDP growth has a clear positive role in the increase of trade openness. Such a conclusion from panel VAR model is consistent to the results by Cavazos and Thompson (2007). Finally, the VAR analysis based on the shock international transmission between NAFTA member countries shows the effect of the increase of Mexico's trade openness in United States and Canada GDP is tiny negative initially and then turns to be positive. On the other hand, the effect of the increase of Canada's trade openness in US GDP is positive. Such a result implies Mexico benefits from NAFTA more than United States and Canada especially in the short run, which is consistent to the results obtained by the mainstream of the researches.