

Tradable Goods Sector Productivity Shocks and Asset Prices ^{*}

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ABSTRACT

By introducing a novel exogenous high frequency measure, I explore asset pricing and macroeconomic dynamics of tradable goods sector productivity (*TSP*) shocks. A positive *TSP* shock reduces consumption in the short run as the economy allocates resources towards exports and investment to raise further productivity. Asset with high sensitivity to the *TSP* shock have lower returns, on average, given that such assets decrease the volatility of agent's consumption stream. The negative *TSP* risk premium is statistically and economically significant and survives a number of robustness tests. Also, I provide evidence that *TSP* shocks contribute to the well documented "size premium."

1 Introduction

The current presidential election in the United States and the British withdrawal from the European Union (Brexit) have brought international trade to the forefront of policy debates. Although there is extensive literature that explores the effects of exports on the economy, the literature remains divided on key issues. Difficulty in identifying an exogenous measure of tradable goods sector productivity (TSP) shocks remains the primary challenge limiting the progress on this subject. The endogeneity and predictability eliminate the application of innovations in real exports as a proxy for TSP shocks. There is limited but growing body of literature that explores the implications of international trade flows on asset returns (see, for e.g., Barrot, Loualiche and Sauvagnat (2015) and Tian (2015)). This paper focuses on trade outflows to enhance this literature.

The goal of this paper is to study the implications of TSP shocks on asset prices and study the macroeconomic dynamics. I utilize financial data to construct a high frequency mimicking portfolio which approximates TSP shocks. The novel measure proposed is the returns to the TMN portfolio, portfolio long firms producing tradable goods minus firms producing non-tradable goods. The results indicate that many of the positive shocks to the TMN portfolio correspond to productivity improvements through reductions in trade barriers and costs (commonly referred to as ‘Globalization’), consistent with the literature that links productivity and lower trade barriers and costs (see, for e.g., Pavcnik 2002; Treffer 2004; Bernard, Jensen and Schott, 2006a, 2006b; Lileeva and Treffer 2010)¹. In order to understand how the TSP shock is reflected in asset prices, I explore its macroeconomic dynamics. The intuition builds on the the

¹There is an alternative hypothesis of ‘learning-by-exporting’ where firms gain new knowledge and expertise after entering the export market (see, for e.g., Van Biesebroeck 2005; De Loecker 2007). However, all such studies are in international markets with ambiguous evidence.

consumption-based capital asset pricing model (C-CAPM) and is as follows: if an asset that covaries positively with the *TSP* shock increases the marginal consumption of the investor, it reduces the volatility of her consumption stream. Investors are willing to pay a higher price to hold assets with lower exposure to systematic risk. I show that a positive *TSP* shock reduces all forms of consumption in the short run as the economy allocates resources towards exports and investment to raise further productivity. Consistent with the intuition, the asset pricing tests reveal that *TSP* shocks are priced in both the time series and the cross section of asset returns. The average annual negative risk premium is approximately -5.38 percent. The negative *TSP* risk premium is both statistically and economically significant and survives a number of robustness tests.

It is well known in literature that firms with low market equity outperform firms with high market equity (see, for e.g., Banz (1981), Fama and French (1992)). In the spirit of Fama (1991, p. 1610) that “hopes for a coherent story that . . . relates the behavior of expected returns to the real economy in a rather detailed way,” I show that *TSP* shocks contribute to the well documented size premium. A positive shock significantly reduces the size premium because larger firms benefit more from a *TSP* shock compared to smaller firms. Using portfolio sorting methods, I show that larger firms are more sensitive to *TSP* shocks than smaller firms. The large firms are attractive to investors despite the lower returns because such firms appreciate in value when marginal consumption is high. Thus, investors are willing to accept lower returns to hold firms with larger market capitalizations. The two-way sorting shows that the size premium disappears conditioned on the exposure to *TSP* shocks.

The literature documents that differences between tradable and non-tradable firms exist even before the actual exporting activity begins. Some firms in the tradable goods sector wait

to enter or abstain from entering the export market given the high sunk costs associated with exporting. An increase in productivity allows firms to enter and compete in international competitive markets (see, for e.g., Roberts and Tybout 1997; Bernard and Jensen 1999; Clerides, Lach, and Tybout 1998). I refrain from using industry value of exports as a measure of tradability as it fails to account for the industries which are more predisposed to exporting and have yet to enter the global market. Instead, I employ Jensen and Kletzer (2005) and Hlatshwayo and Spence (2014) measure of geographical concentration of industries using locational Gini coefficients to classify industries into tradable and non-tradable sectors. The intuition is as follows: industries that produce tradable goods such as manufacturing industries tend to be geographically concentrated, whereas firms producing non-tradable goods such as dentists and cement suppliers are located everywhere. This paper introduces the stock return spread between the tradable goods sector and the non-tradable goods sector as a plausible approximation of the *TSP* shocks.

In order to validate the new measure, I explore its macroeconomic dynamics controlling for exchange rate fluctuations. I find that a positive *TSP* shock simultaneously increases exports and investment, consistent with the micro level findings in Lileeva and Trefler (2010). The exports peak after two quarters and stays above the normal level for six quarters following a shock to the *TMN* portfolio returns. There are two possible interpretation for the increase in exports: an increase in exports emanating from higher supply side productivity, which decreases the relative price of exports; or an increase in exports as a response of higher foreign demand, which increases the relative price of exports. To disentangle these two interpretations, I explicitly examine the response of the relative price of exports in terms of imports, commonly referred to as the *terms of trade*, following a positive shock to the *TMN* portfolio returns. I find

that the *terms of trade* significantly decreases following a positive shock to the *TMN* portfolio returns, implying that the novel measure captures shocks to productivity in the tradable goods sector. The decrease in the relative price of exports is partly in accordance with the literature that suggests trade liberalization leads to lower average export prices via “pro-competitive” effect (Benigno and Thoenissen (2003)).

To determine the sign of the price of risk for the *TSP* shock, I explore the dynamic responses of durable, non-durable and services consumption following a positive *TSP* shock. Although durable and non-durable consumption increase in the long run, all forms of consumption decrease in the short run as the economy allocates resources towards exports and investment to further increase productivity. Short run decrease in consumption implies that holding an asset that covarys positively with the *TSP* shock provides a hedge against consumption risk. Building on the core intuition of the C-CAPM, which dictates that assets with low exposure to consumption risk command higher prices, investors are willing to pay more to hold assets that covary positively with *TSP* shocks. I find that assets with high exposure to the *TSP* shocks tend to have lower returns, on average, than firms with lower sensitivity to *TSP* shocks. The negative *TSP* premium is distinct from the value premium and the size premium. I show that the negative *TSP* risk premium is robust to a number of controls including additional risk factors including the Fama and French (1993) three factors and Carhart (1997) four factors as well as different sets of test assets.

This paper contributes to the newer literature that explores how globalization impacts asset returns. Tian (2015) finds that firms with high tradability have more cyclical output and more cyclical asset returns compared to firms with low tradability. Tian finds that the return spread between the tradable firms minus non-tradable firms positively predicts the real exchange rate,

whereas my measure negatively predicts the real exchange rate and the *terms of trade*. This paper is closely related to Barrot, Loualiche and Sauvagnat (2015) that investigate domestic consequences of foreign productivity shocks. Using industry level shipping costs as an inverse measure of exposure to globalization, they find that firms that are more exposed to globalization command a positive risk premium². This paper differs from Tian (2015) and Barrot, Loualiche and Sauvagnat (2015) because I focus on the consequences of domestic productivity shocks in the tradable goods sector.

This study also contributes to the literature that explores the export led growth hypothesis. The trade literature has debated whether trade causes long term economic growth. Early studies document a positive association between trade and long term growth as a result of greater capacity utilization, economies of scale and better technological improvements (see, for e.g., Balassa 1978; Feder 1982; Kormendi and Meguire 1985). However, Levine and Renelt (1992) find a robust positive association between trade and investment but no such association between exports and growth. I contribute to this literature by documenting a positive long run association between consumption and exports³. Over a ten year window, durable and non-durable consumption increase by 0.12 and 0.07, respectively, for every exporting dollar following a positive shock to *TSP*. In addition, I show that *TSP* shocks significantly increase non-residential investment, consistent with Levine and Renelt (1992).

This paper is organized as follows. Section 2 introduces the new measure of *TSP* shocks. Section 3 explores the macroeconomic dynamics of *TSP* shocks. Section 4 explores the asset pricing results and section 5 concludes.

²Barrot, Loualiche and Sauvagnat (2015) find that firms more exposed to globalization covaries positively with investor's consumption in the U.S.

³Specifically, I document a long run increase in durable and non-durable consumption to a positive *TSP* shocks.

2 Tradable Goods Sector Productivity (TSP) Shocks

This section introduces the exogenous measure of tradable goods sector productivity shocks. The tradable goods sector in the U.S. has evolved over time. Some industries such as information technology (IT) maintenance and support have transformed from the non-tradable to the tradable sector over the last few years (see Spence and Hlatshwayo (2012) for a detailed analysis)⁴. Thus, it is essential that I capture potentially tradable industries that are yet to enter the global market in addition to the ones that are already exporting. In order to identify the tradability of an industry, I use the Jensen and Kletzer (2005) and Spence and Hlatshwayo (2014) measure of geographical concentration of industries using locational Gini coefficients. Intuitively, high industry concentration in a geographic area corresponds to industries that are more likely to produce tradable goods. Famous examples include the high tech industries in Silicon Valley and the auto industry in Detroit.

2.1 Gini Measure

The Gini coefficient is a measure of statistical dispersion among values of a frequency distribution. Gini coefficient of one implies full geographic concentration whereas zero implies the opposite. There are two steps involved in calculating the Gini coefficient. The first component is the industry demand share, which measures the concentration of demand for industry i in region p , which is denoted as

$$\text{Industry Demand Share (IDS)}_{i,p} = \sum_j \left(\frac{Y_{i,j}}{Y_i} \frac{\ln EMP_{j,p}}{\ln EMP_j} \right), \quad (1)$$

⁴Spence and Hlatshwayo (2012) employ this measure to explore the evolving characteristics and trends across industries in the tradable and nontradable sectors of the economy.

where $Y_{i,j}$ is the output of industry i used by industry j . The second component is the locational Gini coefficients by industry,

$$Gini_i = | 1 - \sum_p (\sigma Y_{i,p-1} + \sigma Y_{i,p}) (\sigma IDS_{i,p-1} - \sigma IDS_{i,p}) |, \quad (2)$$

where p is the index regions sorted by industry share of industry employment. The notation $\sigma Y_{i,p}$ represents the cumulative share of industry i 's employment in region p and $\sigma Y_{i,p-1}$ is the cumulative share of industry i 's employment in the region with the next lowest share of industry employment. Lower values of $Gini_i$ suggests a low geographic concentration of industry i , which are characterized as non-tradable industries. Higher values of $Gini_i$ are associated with high geographic concentration of industry i , and are characterized as tradable industries. Intuitively, non-tradable firms (e.g. dentists and cement suppliers) are located in most parts of Metropolitan Statistical Areas, whereas tradable firms (e.g. manufacturing production) tend to be geographically concentrated.

The seasonally-adjusted employment data by industry is from the Bureau of Labor Statistics' Current Employment Statistics and the value added data by industry is from the Bureau of Economic Analysis (BEA). The industry splits are constructed at the two-digit NAICS level. Given that some of the measures may pick up domestic tradability rather than international tradability. I use the Jensen and Kletzer (2005) and Spence and Hlatshwayo (2014) industry splits which adjusts for domestic tradability.

2.2 The *TMN* Portfolio

I merge the industry classification constructed from the Gini coefficients with stock return data from New York Stock Exchange (NYSE), American Stock Exchange (AMEX) and NASDAQ obtained from the Center for Research in Security Prices (CRSP) of the University of Chicago. I exclude financial firms (SIC 6000 – 6799) and utilities (SIC 4900 – 4949) from the sample. The novel measure of the *TSP* shocks is the returns to the value-weighted portfolio long tradable firms minus non-tradable firms, the returns to the *TMN* portfolio. The intuition as follows: the value of the tradable goods sector appreciates more relative to the non-tradable goods sector following a positive shock to the tradable goods sector productivity. The stock return spread reflects the unanticipated news regarding productivity shocks in the tradable goods sector of the economy⁵.

Table 1 shows the composition of the tradable goods sector and the non-tradable goods sector portfolios. Both sectors have similar book-to-market ratios. On average, the tradable firms have higher firm size in comparison to the non-tradable firms. The larger size of tradable firms is consistent with the trade literature (Bernard, Jensen, Redding and Schott (2007))⁶. The debt-to-assets ratio, cash flows-to-assets ratio, operating profit and firm level investment are similar in terms of the median, the 10th percentile and the 90th percentile of the firms for both tradable and non-tradable sectors.

Figure 1 shows the time series of the *TMN* portfolio returns. The top panel plots the *TMN*

⁵Similar reasoning is used in Papanikolaou (2011), where the returns to the portfolio long investment firms minus the consumption firms is used as a proxy for investment specific technological shocks, and in Dissanayake (2016), where the returns to the portfolio long government consumption good producers minus private consumption good producers is used as a proxy for government spending shocks.

⁶Bernard, Jensen, Redding and Schott (2007) find that exporting firms are larger than non-exporting firms by approximately 97 percent in terms of employment and 108 percent in terms of shipments using data for 2002.

portfolio returns that are lagged four quarters and real export of goods⁷. I use the HP filter to remove the cyclical component of export of goods. The lagged *TMN* portfolio returns have a positive correlation of 0.291 (p-value = 0.00) with real exports of goods. The bottom panel plots the *TMN* portfolio returns that are lagged four quarters and real export of services. Similar to the top panel, I use the HP filter to remove the cyclical component of export of services. The lagged *TMN* portfolio returns have a positive correlation of 0.161 (p-value = 0.03) with exports of services. The *TMN* portfolio returns have a much higher correlation with export of goods compared to export of services. Some of the positive *TSP* shocks corresponds to reductions in trade barriers and costs. For example, the third quarter positive shock in 1986 corresponds to the trade negotiations between the U.S. and Canada, which would later become the Canada–United States Free Trade Agreement. The third quarter positive shock in 1990 corresponds to the trade negotiations between the U.S., Canada and Mexico, which would later become the North American Free Trade Agreement (NAFTA). The third quarter positive shock in 2002 corresponds to the U.S. Senate granting authority to the U.S. President to negotiate a free trade agreement with Chile and a few other countries. Thus, reductions in trade barriers and costs play an important role in productivity shocks in the tradable goods sector in the U.S.

⁷The real exports data are from the Bureau of Economic Analysis (BEA) database. The innovations in real exports are the simple quarterly change in real exports.

3 Macroeconomic Dynamics

In order to validate the new measure of *TSP* shocks, I explore its the macroeconomic dynamics in this section. I estimate the following Vector Autoregression (VAR),

$$X_t = A(L)X_{t-1} + \varepsilon_t, \quad (3)$$

where X_t is the vector of variables, $A(L)$ is a polynomial in the lag operator and ε_t is a vector of white-noise disturbances that may be correlated. For better accuracy, following Dissanayake (2016), I use quarterly data, four lags of each variable and a quadratic time trend. Macroeconomic variables are from the U.S. BEA database. I follow the recent macroeconomic literature and use a fixed set of variables and rotate in other variables of interest, one at a time (see, for e.g., Burnside, Eichenbaum, and Fisher (2004), Ramey (2011) and Dissanayake (2016)). The fixed set of variables consists of the *TSP* shocks proxied by the returns to the *TMN* portfolio, the excess market returns, the investment specific technological (*IST*) shocks proxied by the returns to the *IMC* portfolio, the real exchange rate, the log of real per capita exports, the log of real per capita imports, the log of real per capita GDP, and the three-month t-bill rate to account any monetary fluctuations⁸. I control for technological shocks because the recent trade literature finds that the impacts of technology and the impacts of trade are separable in the U.S. (Autor, Dorn and Hanson (2013)). The macroeconomic literature finds that *IST* shocks account for the majority of economic growth in the U.S. (see, for e.g., Greenwood, Hercowitz and Krusell 1997; 2000; Fisher 2006). I use returns to the *IMC* portfolio, portfolio long in-

⁸Papanikolaou (2011) shows that the returns to the *IMC* portfolio, portfolio long investment good producers minus consumption good producers proxy investment specific technological shocks. However, the pricing of *IMC* portfolio returns are debated in literature. Dissanayake, Watanabe and Watanabe (2016) show that *IMC* portfolio returns are priced in international equity markets and are stronger in more developed markets.

vestment minus consumption good producers, to control for *IST* shocks. The quarterly *TMN* portfolio returns are compounded from monthly returns. The real effective exchange rate data is from the International Monetary Fund's International Financial Statistics database. The additional variables considered are the *terms of trade*, the log of per capita labor hours, the log of real business wage, the log of real per capita non-residential investment, the log of real per capita non-durable, durable, and services consumption.

Figure 2 presents the orthogonalized impulse response functions from the VARs and the 95 percent bootstrapped standard error bands. The responses are normalized such that the maximum response of real exports to a positive *TMN* shock is equal to one⁹. The response of exports remains significantly above steady state level for ten quarters and peaks four quarters after the *TSP* shock. There is little change in imports, output, labor hours, and business wage following the *TSP* shock. The results are in accordance with Levine and Renelt (1992) that find no significant evidence for exports led long term growth in the U.S. The modest increase in the t-bill rate is consistent with the anticipation effect of higher demand for U.S. dollars by exporting firms. The per capita non-residential investment increases following a positive *TSP* shock, consistent with the literature that find better access to foreign markets encourage firms to export and invest in capital that raise productivity (Lileeva and Trefler 2010). I find that for 1 percent increase in exports following a *TSP* shock, non-residential investment increases by 0.99 percent.

I disentangle whether a positive shock to the *TMN* portfolio returns capture an increase in foreign demand or an increase in supply side productivity by exploring the response of the *terms of trade*. A productivity increase in the tradable goods sector decreases the production

⁹This is for easy interpretation of the results.

cost of export goods, deteriorating the terms of trade (Benigno and Thoenissen (2003)). In contrast, a positive demand shock increases the *terms of trade* and thus the ability to increase production at a higher price. Figure 2 shows that the *terms of trade* significantly decreases following a positive shock to the *TMN* portfolio returns, implying that the *TMN* portfolio returns capture mostly supply side productivity shocks.

I explore the response of consumption to a positive *TSP* shock to motivate the asset pricing implications. The last three panels of Figure 2 shows the response of non-durable consumption, durable consumption and services consumption. All three forms of consumption decrease in the short run following a positive *TSP* shock. The non-durable consumption decreases much less than the durable consumption as a result of investor preference for consumption smoothing. The short run decrease in consumption implies that *TSP* shocks are associated with a negative risk premium. The standard asset pricing theory suggests that an asset's price is raised, or equivalently an asset's return is lowered, if it covaries negatively with consumption (Cochrane 2005). The short run increase in marginal consumption suggests that assets that covary positively with the tradability shock have lower returns. Assets that covary positively with the *TSP* shock helps smooth consumption and are valued by investors.

Figure 2 shows a long run increase in both durable and non-durable consumption following a positive *TSP* shock. However, I find that services consumption remains steady over time. In order to quantify the benefits for consumers, I examine the cumulative response of consumption over the ten year window. For ever dollar exported as a result of a positive *TSP* shock, durable consumption and non-durable consumption increase by approximately 0.12 and 0.07, respectively. On the other hand, for ever dollar exported as a result of a positive *TSP* shock, services consumption decreases by -0.43 .

4 Asset Pricing Results

In this section, I examine whether *TSP* shocks are priced in asset returns using both time series and cross sectional asset pricing tests. The time series tests include one-way and two-way portfolio sorting tests. The cross sectional tests include a number of estimations using the generalized method of moments (GMM) framework. The stock return data is from NYSE, AMEX and NASDAQ stock exchanges obtained from the CRSP database. Following Fama and French (1992), I exclude all financial and utility firms from the sample given their unusually high leverage. The accounting data is from the COMPUSTAT database. A firm must have a December fiscal-year end and at least two years of data to be included in the sample.

The market value of equity (ME), the stock price times the number of shares outstanding, is computed end of June each year using CRSP data. Following Fama and French (1993), the book value of equity (BE) is the COMPUSTAT book value of stockholders' equity (data item 60), plus balance sheet deferred taxes (data item 74) and investment tax credits (data item 208) minus the book value of preferred stock. Depending on the availability of data, I use the redemption (data item 56), liquidation (data item 10), or par value (data item 130) of preferred stock. The book-to-market equity (BE/ME) is the book equity for the fiscal year ending in calendar year $t - 1$ divided by market equity at the end of December of $t - 1$. Only firms with ordinary equity are included in the asset pricing tests. Negative or zero book values are treated as missing. I use further screening to satisfy the standard requirements in finance literature. The sample time period is from 1964 to 2015.

4.1 Exposure to TSP shocks

I use a firm's stock return beta with respect to the *TMN* portfolio returns as the measure of firm sensitivity to the *TSP* shock. I control for the exposure to other sources of systematic risk in the economy by including the value weighted excess market returns, *mkt*, and for *IST* shocks by including the returns to the *IMC* portfolio. Specifically, for each firm *i*, I estimate the time series regression,

$$r_{i,t} - r_{f,t} = \alpha_{i,t} + \beta_{i,t}^{MKT} r_t^{MKT} + \beta_{i,t}^{IMC} r_t^{IMC} + \beta_{i,t}^{TMN} r_t^{TMN} + \epsilon_{i,t}, \quad (4)$$

where $t = 1, \dots, 120$, $r_{f,t}$ is the risk free rate, r_t^{MKT} is the excess market returns, r_t^{IMC} is the returns to the *IMC* portfolio and r_t^{TMN} is the *TMN* portfolio returns. I use a 120 month window to estimate the $\beta_{i,t}^{TMN}$. Following Fama and French (1992), I require atleast 24 observations to be included in the sample.

4.2 Portfolio Sorting

The portfolio sorting follows Fama and French (1993). Specifically, I sort firms in to five portfolios (quintiles) by their sensitivity to the *TSP* shock. In June of each year, all stocks are ranked by their *TMN* beta. The stocks are then allocated to the *TMN* portfolio quintile based on the breakpoints. Table 2 reports the portfolio quintiles sorted by the exposure to the *TMN* portfolio returns, β^{TMN} . The β^{TMN} range from -1.70 to 0.86 , capturing a sizable variation in sensitivity to *TSP* shocks. The equal-weighted and value-weighted excess returns decrease monotonically as the average β^{TMN} increases. The monthly value-weighted and equal-weighted return spread between the highest quintile (portfolio with highest sensitivity to the *TSP* shock)

and the lowest quintile (portfolio with lowest sensitivity to the TSP shock) is -0.515 percent and -0.448 percent, respectively. This corresponds to an annual value-weighted return spread of -5.38 percent, which is slightly smaller than the equity premium in the post-Compustat era¹⁰. The equal-weighted and the value-weighted return spreads between high minus low quintiles are significant at the 5 percent level using Newey-West (1987) standard errors. The results imply that exposure to the TSP shock reduces the average excess returns of the assets, consistent with the intuition derived using consumption dynamics.

The Capital Asset Pricing Model (CAPM) suggests that asset returns increase as their exposure to the excess market returns, measured by β^{MKT} , increases. However, the β^{MKT} displays a U-shaped pattern, thus, the traditional CAPM fails to price portfolios sorted on the sensitivity to the TSP shock. The IST literature finds that firms with high exposure to IST shocks have lower returns, on average, compared to firms with low exposure to IST shocks. I find that quintiles with lower returns are associated with low β^{IMC} implying that IST shocks and TMN shocks capture separate systematic risk. The portfolios display an inverse U-shaped pattern with respect to the book-to-market ratio. Thus, the negative return spread is driven by factors other than the book-to-market ratio.

Although not monotonic, the average size of firms in each portfolio increases as the β^{TMN} increases. This suggests that firms with high exposure to TSP shocks are generally larger firms, consistent with Bernard, Jensen, Redding and Schott (2007). To investigate the association between sensitivity to the TSP shock and firm size, I explore the response of the size premium to a positive shock to the TMN portfolio returns. I employ the SMB portfolio in the VAR framework described in (3) controlling for the same fixed set of variables¹¹. Figure 3 shows that

¹⁰The equity premium is approximately 6.1 percent since 1963.

¹¹ SMB is the the return on a diversified portfolio of small stocks minus the return on a diversified portfolio

the size premium significantly decreases upon a positive TSP shock providing further evidence that larger firms benefit more from a TSP shock compared to smaller firms.

To further analyze the association between the sensitivity to the TSP shock and firm size, I employ two-way portfolio sorting methodology. First, I sort portfolios by book-to-market and size following Fama and French (1993). The results are presented in Table 3. The first panel in Table 3 shows the average β^{TMN} for each portfolio. The β^{TMN} has an increasing pattern within each book-to-market quintile. The β^{TMN} spread between the big minus small size quintiles is positive and significant among all book-to-market quintiles. The third panel shows that the size premium is significant among the high book-to-market quintiles. Again, the CAPM fails to price the decreasing returns to the size portfolios.

Given the positive association between firm size and β^{TMN} , I examine the robustness of the negative TSP risk premium conditional on firm size. I sort firms in the sample by β^{TMN} and firm size and the results are presented in Table 4. The size premium disappears conditional on the exposure to the TSP shock. The TSP risk premium is negative and significant for size quintiles one through four. The negative TSP risk premium becomes larger as the size quintile increase. This is consistent with the larger firms being more likely to enter and compete in international markets compared to their smaller counterparts. However, I find that the TSP risk premium is not significant within the largest size quintile. Given that the largest firms in the sample have limited growth potential, they are unlikely to benefit from increased exporting opportunities.

of big stocks. The SMB factor is from Kenneth French's web site

4.3 Cross Sectional Tests

The cross sectional tests are performed using the one-step GMM as described in Cochrane (2005, pp.241 – 243) and the Fama and Macbeth (1973) two-step procedures. The first set of tests use the GMM procedure where the moment conditions simultaneously include the time-series orthogonality conditions, restrictions on the portfolio excess returns on a vector of factors, as well as the cross-sectional orthogonality conditions, restrictions on the portfolio excess returns on the factor loadings.

Table 5 shows the correlations between the risk factors used in the cross sectional estimations. The *SMB* factor is the the return on a diversified portfolio of small stocks minus the return on a diversified portfolio of big stocks and the *HML* factor is the difference between the returns on diversified portfolios of high and low book equity to market equity stocks (Fama and French (1993)). The *RMW* factor is the difference between the returns on diversified portfolios of stocks with robust and weak profitability and the *CMA* factor is the difference between the returns on diversified portfolios of the stocks of conservative and aggressive investment firms (Fama and French (2015)). The *TMN* portfolio returns have a low correlation with the excess market returns and the *HML* portfolio returns. The results show that the *TMN* portfolio returns are negatively correlated with *SMB* and *RMW* factors.

Table 6 presents the GMM results using 25 portfolios sorted on β^{TMN} and market equity. I report the mean absolute pricing errors (MAPE), the J-test of the overidentifying restrictions of the model and its corresponding p-values. The standard errors are adjusted using Newey West (1987) corrections using a 12 months lag. The first two specifications show that the *TSP* risk premium is significantly priced in the cross section of asset returns. The reduction

in MAPE implies that the addition of the *TSP* shock improves on the traditional CAPM. The monthly *TSP* risk premium is -0.40 percent, which is similar in magnitude to the risk premium calculated using portfolio sorting. The *TSP* risk premium is statistically significant at the 5 percent level in the first two specifications and at the 10 percent significant level for the remaining specifications. The results show that the magnitude of the *TSP* risk premium remains robust to the inclusion of the Fama and French (1993) three factors, the Carhart (1997) four factors and the more recent Fama and French (2015) five factors. The mean absolute pricing errors decrease as the *TMN* portfolio returns are added to each specification.

Finally, I explore whether the *TSP* risk premium is robust to the inclusion of financial market anomalies. Jagadeesh and Titman (1993) document that buying stocks that have performed well in the past and selling stocks that have performed relatively poorly in the past, the momentum strategy, generates positive returns. Also, the literature shows that the short term return reversals explain asset prices (e.g. Jegadeesh (1990), Lehmann (1990), and Lo and MacKinlay (1990)). Possible explanation for short term return reversal profits include investor overreaction to information and positive cross autocorrelation in stock returns. The long term return reversals is another well documented market anomaly. Contrarian strategists buy portfolios composed of securities with low long term past returns and sell portfolios of stocks with high long term past returns. DeBondt and Thaler(1985; 1987) show that such contrarian strategies generate positive returns and attribute such profits to investor overreaction. Table 7 shows the cross sectional results using 25 portfolios sorted on momentum and size. For additional robustness, I use the Fama and Macbeth (1973) two pass regressions. The results show that the *TSP* risk premium remains robust to the inclusion of the momentum factor, *MOM*, the short term reversal factor, *STR*, and the long term reversal factors, *LTR*. The negative

TSP risk premium is significant the the 5 percent level for specifications (I) through (IV) and significant the the 10 percent level for specifications (V). Overall, the results imply that the *TSP* risk premium is robust to the inclusion of financial market anomalies.

5 Conclusion

This paper provides evidence that tradable goods sector productivity (*TSP*) shocks are reflected in the time series and the cross section of asset returns. Assets with high sensitivity to the *TSP* shock have lower returns, on average, compared to assets with lower sensitivity to the *TSP* shock. The cross sectional estimations show that the negative *TSP* risk premium is robust to the use of different test portfolios and the inclusion of different risk factors. I show that the addition of the *TSP* shock significantly improves on the standard capital asset pricing model, the Fama and French (1993) three factor model and the Carhart (1997) four factor model.

In order to approximate the *TSP* shock, I employ a novel measure using financial data. The novel measure proposed is the returns to the *TMN* portfolio, the portfolio long firms producing tradable goods minus firms producing non-tradable goods. I explore the response of consumption to provide a sound explanation for the *TSP* risk premium. All forms of consumption falls in the short run as the economy allocates resources towards exports and investment to raise further productivity. Thus, assets that covary positively with the *TSP* shock help smooth household consumption, commanding a negative risk premium.

6 References

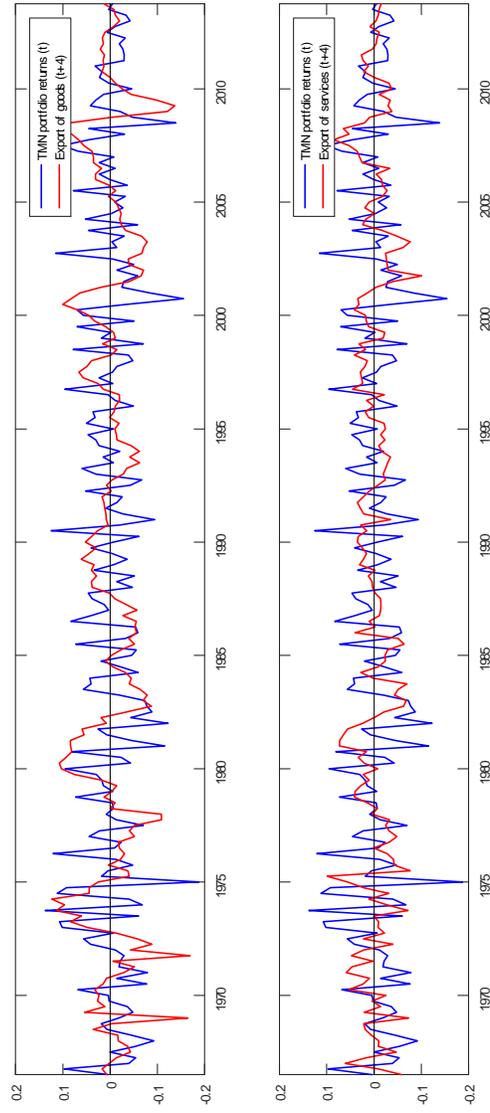
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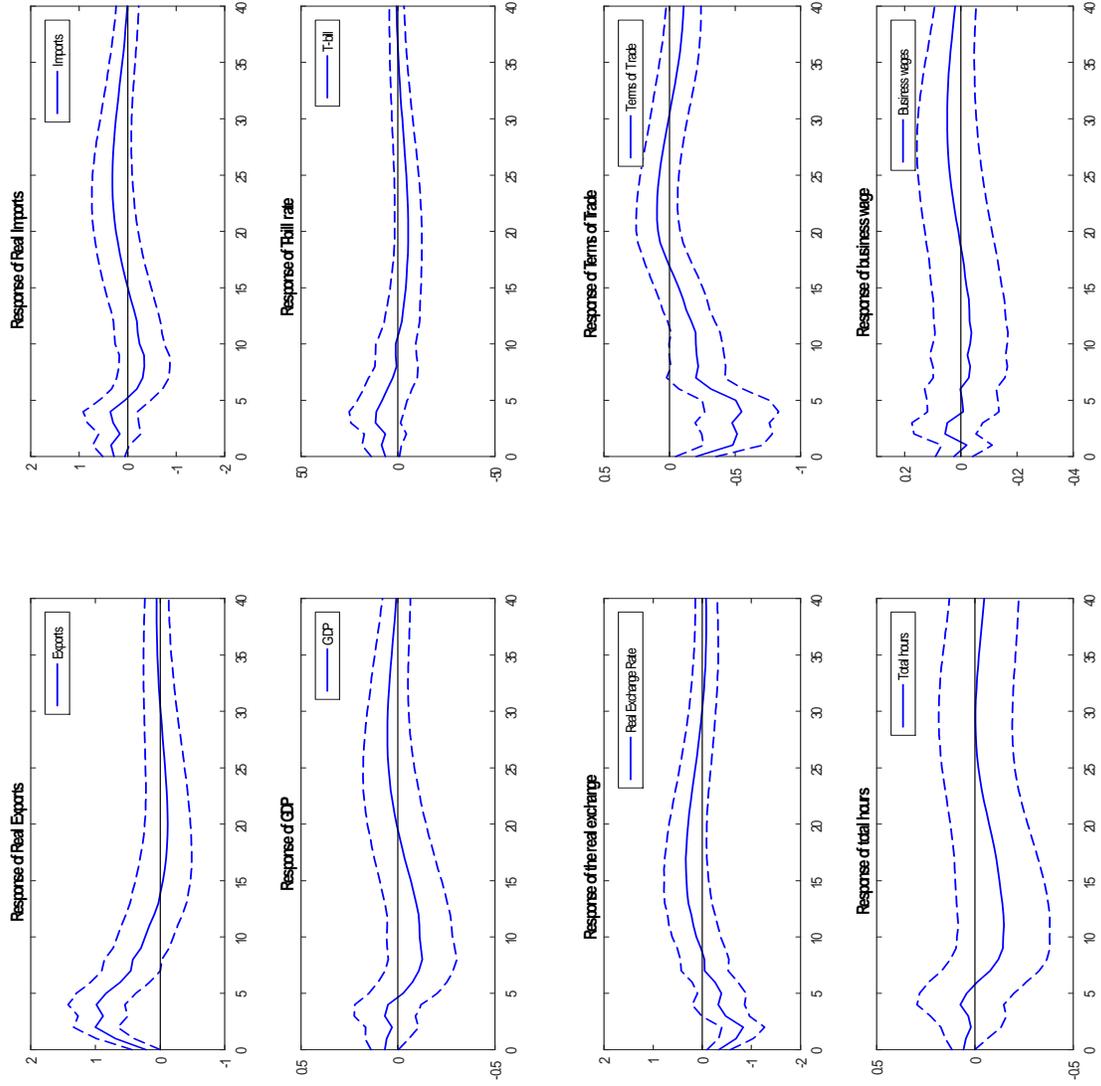
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Figure 1: Returns to the TMN Portfolio and Real Export of Goods and Services



I de-trend the export data with the Hodrick–Prescott filter with a smoothing parameter of 1,600 to remove the cyclical components. The TMN portfolio is the portfolio long firms producing tradable goods minus firms producing non-tradable goods.



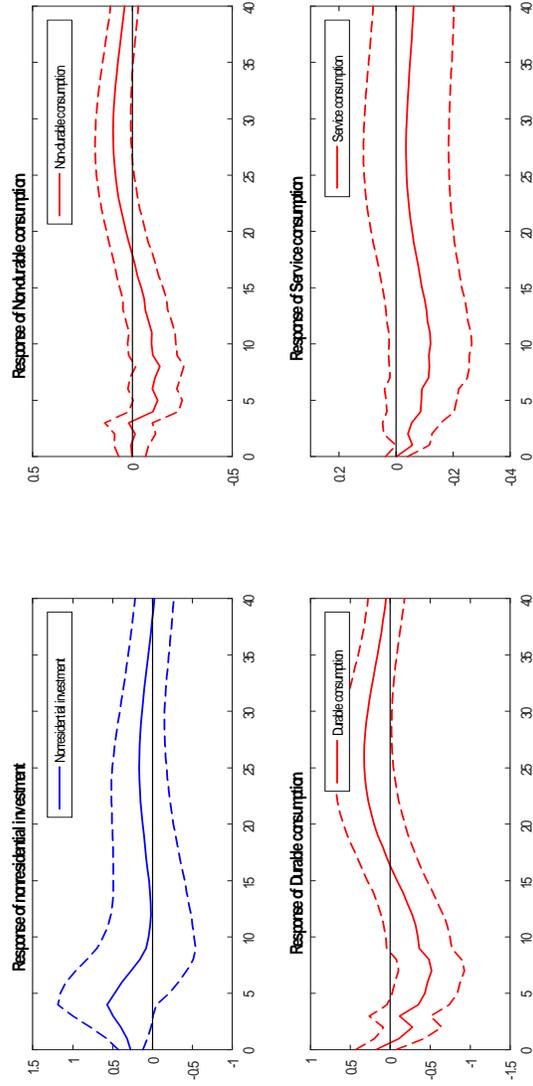


Figure 2: Response to a positive Tradable Goods Sector Productivity Shock

The dotted lines represent 95% bootstrapped standard error bands. The sample includes quarterly data from 1964 to 2015. The macroeconomic variables are from the U.S. Bureau of Economic Analysis.

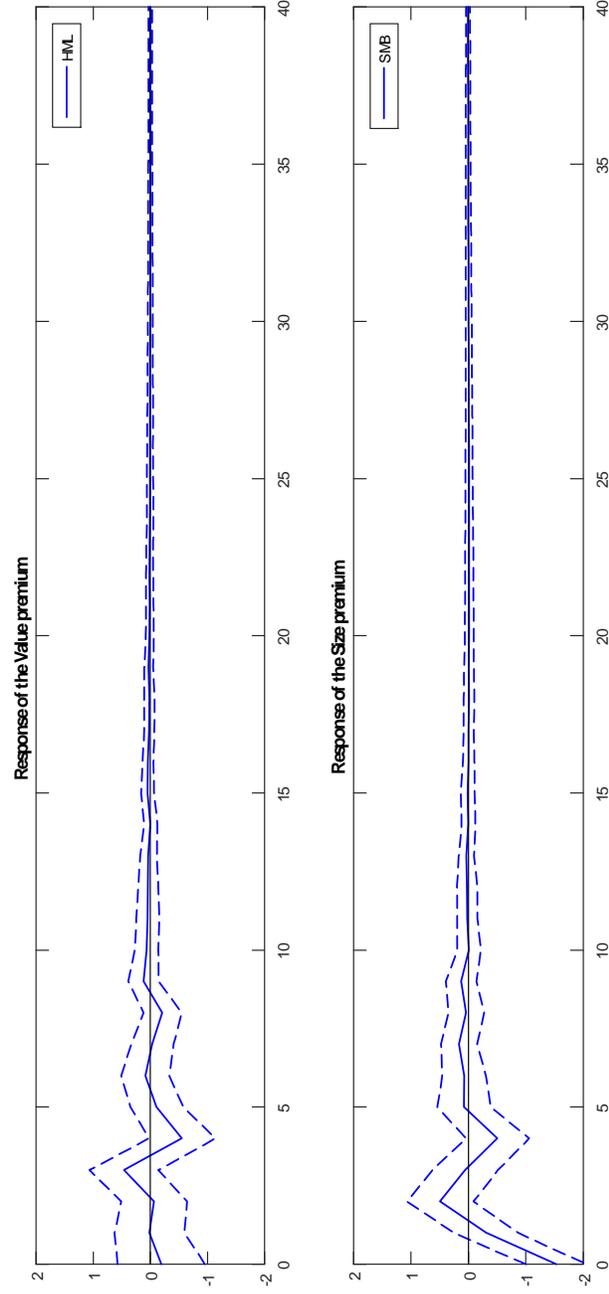


Figure 3: Response to a positive Tradable Goods Sector Productivity Shock

The dotted lines represent 95% bootstrapped standard error bands. The sample includes quarterly data from 1964 to 2015. HML is the difference between the returns on diversified portfolios of high and low book-to-market equity stocks and the SML factor SMB is the difference between the returns on diversified portfolios of small and big market equity stocks.

Table 1: Tradable minus Non-tradable Portfolio Composition

	Tradable Sector Portfolio			Non-Tradable Sector Portfolio		
	Median	10%	90%	Median	10%	90%
Book-to-market equity	0.665	0.166	2.166	0.709	0.193	2.162
Market capitalization	188.24	9.28	4479.84	145.73	7.08	3389.74
Debt to Assets	0.214	0.000	0.481	0.278	0.017	0.581
Cash flows to Assets	0.086	-0.076	0.170	0.079	-0.005	0.160
Operating Profit	0.220	-0.137	0.481	0.241	-0.034	0.486
Investment	0.062	-0.138	0.367	0.068	-0.110	0.339
Number of firms	1796			460		

This table reports the portfolio composition of the Tradable Sector firms and the Non-tradable sector firms. I report the book-to-market equity, market equity, debt to assets ratio (Compustat item dlta plus item dlc divided item at), the cash flows to assets ratio (Compustat item ib plus item dp divided by item at), the operating profitability (Compustat item revt minus item cogs minus XSGA, zero if missing, minus XINT, zero if missing, divided by book equity for the fiscal year ending in calendar year t-1) and the investment to assets ratio (change in Compustat item at divided by lag item at). The sample includes data from 1964 to 2015.

Table 2: Excess Returns and Covariances of 10 Portfolios Sorted on TMN beta

TMN beta	L	2	3	4	5	H-L
Equal-Weighted						
Mean excess return	1.201	1.130	1.051	1.048	0.786	-0.415
(t-stat)	(3.74)	(4.25)	(4.24)	(4.21)	(2.46)	(-2.57)
Value-weighted						
Mean excess return	0.870	0.784	0.774	0.658	0.422	-0.448
(t-stat)	(3.56)	(3.48)	(3.58)	(3.36)	(1.94)	(-2.35)
Characteristics						
β^{TMN}	-1.702	-0.753	-0.372	-0.013	0.864	
β^{mkt}	1.018	0.977	0.946	0.958	1.111	
β^{imc}	0.758	0.428	0.336	0.305	0.375	
Size	1016.1	1123.7	1875.7	3533.1	2854.5	
B/M	0.729	0.841	0.829	0.802	0.720	

The table reports the value-weighted and equal-weighted excess returns for portfolios sorted on TMN exposure. Standard errors are corrected using Newey-West (1987) procedure with 12 lags. The exposure to the TSP shock, β^{TMN} , the exposure to the IST shock, β^{imc} , and the exposure to the excess market returns, β^{mkt} , are calculated using regressions with the prior 120 months of data. The sample includes data from 1964 to 2015.

Table 3: Portfolios sorted on Book-to-Market equity and Size

i) β^{TMN}					
	B/M				
	1	2	3	4	5
S	-0.394	-0.441	-0.417	-0.423	-0.433
2	-0.408	-0.474	-0.489	-0.439	-0.448
3	-0.429	-0.441	-0.412	-0.375	-0.366
4	-0.371	-0.348	-0.303	-0.278	-0.256
B	-0.195	-0.183	-0.072	-0.014	0.064
(B-S)	0.199	0.257	0.345	0.409	0.497
	(1.76)	(3.42)	(3.75)	(6.04)	(5.48)

ii) Book-to-market equity					
	B/M				
	1	2	3	4	5
1	0.227	0.483	0.687	0.957	1.974
2	0.245	0.481	0.684	0.938	1.602
3	0.253	0.478	0.680	0.937	1.545
4	0.253	0.476	0.678	0.939	1.475
5	0.247	0.472	0.676	0.931	1.483
Size					
1			(-0.66)		
2			(-0.56)		
3			(0.82)		
4			(1.36)		
5			(2.02)		

iii) Excess returns					
	B/M				
	1	2	3	4	5
S	0.282	0.939	1.024	1.128	1.185
2	0.571	0.898	1.013	0.973	1.007
3	0.677	0.965	0.905	0.948	1.025
4	0.772	0.790	0.910	0.826	0.944
B	0.518	0.680	0.672	0.640	0.699
(S-B)	-0.236	0.259	0.352	0.488	0.486
	(-0.83)	(1.08)	(1.66)	(1.98)	(1.71)

iv) Size					
	B/M				
	1	2	3	4	5
1	88.2	89.6	90.4	82.2	59.4
2	424.4	432.3	423.9	419.1	401.3
3	1025.5	1007.6	1000.1	996.8	985.7
4	2581.0	2501.9	2436.5	2403.6	2383.5
5	20911.0	19135.5	16673.2	15582.3	13315.4
Size					
1			(3.62)		
2			(1.81)		
3			(1.67)		
4			(0.78)		
5			(0.70)		

v) β^{mkt}					
	B/M				
	1	2	3	4	5
1	1.049	0.995	0.944	0.920	0.870
2	1.220	1.108	1.061	1.040	1.064
3	1.157	1.079	1.044	1.035	1.046
4	1.115	1.048	1.058	1.079	1.097
5	1.049	1.015	0.991	0.984	1.014
Size					
1			261.1	188.4	209.8
2			95.8	81.9	85.1
3			78.9	68.8	60.1
4			78.5	60.0	45.3
5			89.1	52.3	34.5

vi) Number of firms					
	B/M				
	1	2	3	4	5
1	261.1	188.4	209.8	286.1	533.5
2	95.8	81.9	85.1	84.6	58.2
3	78.9	68.8	60.1	48.8	31.1
4	78.5	60.0	45.3	35.4	20.0
5	89.1	52.3	34.5	24.6	14.0

The table reports summary statistics for portfolios sorted on book-to-market equity and Size. Standard errors for β^{TMN} are corrected using Newey-West (1987) procedure with 60 lags. Standard errors for returns are corrected using Newey-West (1987) procedure with 12 lags. The exposure to the tradability shock, β^{TMN} , and the exposure to the excess market returns, β^{mkt} , are calculated using the prior 120 months of data. The sample includes data from 1964 to 2015.

Table 4: Portfolios sorted on TMN beta and Size

i) Average excess returns		β^{TMN}					ii) Average β^{TMN}					
		1	2	3	4	5	Average β^{TMN}					
		(5-1)					1	2	3	4	5	
S		0.997	1.099	0.983	0.941	0.658	1	-1.765	-0.757	-0.373	-0.009	0.936
2		0.905	1.024	0.965	0.833	0.500	2	-1.605	-0.756	-0.377	-0.019	0.777
3	Size	0.940	0.983	0.871	0.928	0.459	3	-1.519	-0.746	-0.375	-0.018	0.745
4		1.070	0.947	0.799	0.866	0.518	4	-1.447	-0.737	-0.368	-0.023	0.684
B		0.736	0.641	0.744	0.620	0.438	5	-1.383	-0.732	-0.357	-0.011	0.671
(S-B)		0.261	0.458	0.238	0.321	0.220						
		(0.72)	(1.42)	(0.86)	(1.16)	(0.73)						
iii) Average Size		β^{TMN}					iv) Number of firms					
		1	2	3	4	5	Average β^{TMN}					
1		84.1	83.2	80.6	73.4	67.8	1	332.2	292.5	271.4	274.3	308.6
2		421.0	426.4	420.9	422.8	413.9	2	80.9	95.1	88.2	77.0	64.4
3	Size	990.9	1000.8	1024.1	1004.5	1001.8	3	49.6	68.1	69.2	57.8	43.0
4		2483.3	2411.3	2485.5	2580.0	2519.6	4	33.8	48.2	58.6	57.6	40.9
5		14434.4	10941.1	13657.1	22728.3	27342.2	5	18.2	27.3	46.6	65.6	56.8

The table reports summary statistics for value-weighted excess returns and the average exposure to trade sector productivity shocks for portfolios of firms sorted on β^{TMN} and Size. Standard errors are estimated using Newey-West (1987) with 12 lags. The exposure to the tradability shock, β^{TMN} , and the exposure to the excess market returns, β^{mkt} , are calculated using a regression with the prior 120 months of data. The sample includes data from 1964 to 2015.

Table 5: Risk Factor Correlations

Factors	TMN	MKT	SMB	HML	RMW	CMA	MOM	STR	LTR	IMC
TMN	1.0000									
MKT	-0.0794*	1.0000								
SMB	-0.2467**	0.2834**	1.0000							
HML	-0.0314	-0.3043**	-0.1216**	1.0000						
RMW	-0.2217**	-0.2076**	-0.3642**	0.0896**	1.0000					
CMA	0.0615	-0.3936**	-0.1196**	0.7029**	-0.0834**	1.0000				
MOM	0.1229**	-0.1281**	-0.0216	-0.1585**	0.0955**	0.0021	1.0000			
STR	-0.0888**	0.2846**	0.1571**	-0.0156	-0.0568	-0.1360**	-0.2839**	1.0000		
LTR	-0.1193**	-0.0299	0.2968**	0.4187**	-0.3064**	0.4835**	-0.0543	0.0776*	1.0000	
IMC	0.2833**	0.3004**	0.3072**	-0.2284**	-0.2768**	-0.2333**	-0.0658	0.0667	0.0066	1.0000

This table reports the correlation, measure the strength and direction of the linear relationship, between the risk factors. Statistical significance at the 5%, and 10% levels is indicated by **, and *, respectively. TMN is the Tradable minus Non-tradable portfolio returns. MKT is the return on the value-weighted market portfolio, SMB is the portfolios of small stocks minus big stocks, HML is the difference between the portfolios high and low book-to-market stocks, RMW is the difference between the returns on portfolios of stocks with robust and weak profitability, and CMA is the difference between the returns on portfolios of low and high investment stocks. MOM is the momentum factor, STR is the short term reversal factor and LTR is the long term reversal factor. IMC is the portfolio returns of the investment minus consumption good producers. The sample includes monthly data from 1965 to 2015.

Table 6: Estimated Premia

25 Portfolios Sorted on TMN beta and Size								
Factor	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)
Const	1.151*** (4.27)	0.944** (2.06)	0.433 (0.88)	0.882** (1.99)	0.071 (0.12)	0.752 (1.61)	1.079* (1.77)	0.740 (1.42)
MKT		0.187 (0.36)	0.670 (1.35)	0.190 (0.39)	1.077* (1.68)	0.335 (0.68)	-0.003 (-0.01)	0.352 (0.63)
TMN	-0.401*** (-3.23)	-0.394** (-2.42)		-0.407* (-1.82)		-0.385* (-1.67)		-0.458* (-1.66)
SMB			0.084 (0.46)	0.166 (0.90)	0.085 (0.43)	0.162 (0.84)	0.229 (1.11)	0.107 (0.56)
HML			0.886*** (2.60)	0.716*** (2.72)	0.904** (2.33)	0.732** (2.47)	0.380 (0.96)	1.050** (2.73)
MOM					1.047 (0.82)	0.132 (0.13)		
RMW							0.339 (1.14)	-0.154 (-0.52)
CMA							-0.113 (-0.33)	0.462 (1.50)
J-stat	5.867	6.231	4.818	4.125	4.827	3.855	4.252	3.805
p-value	(0.99)	(0.99)	(0.99)	(0.99)	(0.99)	(0.99)	(0.99)	(0.99)
MAPE	1.924	1.702	1.474	1.253	1.338	1.179	1.266	1.125

This table reports the first-stage GMM estimates using the identity weighting matrix. I report the mean absolute pricing errors (MAPE) and the J-test of overidentifying restrictions along with p-values in brackets. The t-statistics are reported in brackets using Newey-West standard errors, allowing for one lag. MKT, SMB, HML, RMW, CMA are the excess market returns, size, book-to-market, profitability and investment factors, respectively. TMN is the Tradable minus Non-tradable firms portfolio return. The SMB, HML, RMW and CMA factors are taken from Kenneth French's Web site. The sample includes monthly data from 1975 to 2015. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

Table 7: Tradable Sector Productivity Shocks vs Market Anomalies

Factor	25 Portfolios Sorted on Momentum and Size				
	(I)	(II)	(III)	(IV)	(V)
Const	0.891 ^{***} (3.42)	0.862 ^{***} (3.49)	1.014 ^{**} (2.34)	0.839 [*] (1.96)	0.232 (0.49)
MKT	0.121 (0.31)	0.162 (0.43)	0.027 (0.05)	0.178 (0.31)	0.778 (1.17)
TMN	-0.728 ^{**} (-1.98)	-0.806 ^{**} (-2.04)	-1.163 ^{***} (-2.62)	-1.095 ^{**} (-2.23)	-0.974 [*] (-1.83)
MOM	0.759 ^{***} (2.88)	0.745 ^{***} (2.87)	0.731 ^{***} (2.76)	0.754 ^{***} (2.69)	0.739 ^{**} (2.52)
STR	0.753 (0.94)			1.473 ^{**} (2.28)	1.162 [*] (1.82)
LTR		0.275 (0.72)			1.518 ^{**} (1.97)
SMB			0.354 [*] (1.80)	0.282 (1.34)	0.253 (1.13)
HML			-0.305 (-0.85)	-0.297 (-0.76)	0.408 (0.79)

This table reports the Fama and Macbeth estimates. The t-statistics are reported in brackets using Shanken (1992) corrections. MKT, SMB, HML are the excess market returns, size, and book-to-market, respectively. TMN is the Tradable minus Non-tradable firms portfolio return. Mom is the monthly momentum factor. ST Rev is the monthly short term reversal factor and LT Rev is the long term reversal factor. The HML, SMB, Mom, STR and LTR factors are taken from Kenneth French's web site. The sample includes monthly data from 1964 to 2015. Statistical significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.