Chapter 7

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CHAPTER 7

Globalisation and the Income Risk of Australian Workers

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We study the relationship between one particular aspect of globalisation (international trade) and labour income risk using eleven waves of the annual Household Income and Dynamics in Australia (HILDA) Survey data over 2001-2011. Based on within-industry variation over three sub-periods of the data, we find some evidence for a positive correlation between import penetration and Australian workers' income risk across sectors. The positive correlation is stronger for the manufacturing industries than for the services industries when permanent income risk is considered. The evidence is, however, less clear for the case of transitory income risk.

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1. Introduction

The study in this report investigates the empirical relationship between globalisation and individual income risk faced by Australian workers as import competition increased. The aim of the study is to contribute to a better understanding of the effects of globalisation on domestic economic performance by considering a less frequently investigated channel through which globalisation may affect the welfare of domestic economy. While increased cross-border economic activities brought about by globalisation have many potential benefits such as improved allocational efficiency of resources, many have argued that they may also have some downsides. One particular downside that has increasingly received attention in the recent time is an increase in individual labour income risk. Globalisation may result in domestic workers facing higher economic uncertainty and income and therefore experiencing a reduction in their welfare even in the absence of lower average income. If such welfare reducing effect from increased income risk due to globalisation is significant and if it is not recognised during policy making then the resulting domestic policy response to globalisation may be suboptimal.

There is an extensive list of studies that look at how globalisation may be negatively associated with the incomes of workers in the domestic economies. However, most of these studies focus on the mean (or level) effects of globalisation. Thus, even if they have uncovered interesting and important findings on whether or not and how globalisation affects the level and distribution of incomes in the affected countries, they have been relatively silent with regards to how workers' income uncertainty may also increase as a result of globalisation. This is indeed rather disappointing because, as stressed by Menezes-Filho & Muendler (2011), "[a]t the

heart of welfare gains from trade is the expansion of consumption possibilities and the reallocation of production factors. Yet research to examine the impact of trade liberalization on workers' individual employment trajectories across employers over time is scant."

In theory, there are several reasons why changes in trade openness may affect individual labour income volatility. First, as a country opens its border, its import competing sectors become more exposed to the volatility of the international markets. Second, increased foreign competition may increase the demand elasticity of labour through the increased demand elasticity of products. In that case, shocks to labour demand would lead to a higher volatility in labour market outcomes. On the other hand, globalization may be associated with a lower level of individual income volatility if the international aggregation of shocks across countries resulted in a lower overall volatility. In other words, the link between globalization and individual income uncertainty is an empirical question waiting to be solved. Furthermore, because the relationship may vary from country to country, it is important to investigate the issue using individual micro data from many different countries.

This study applies a similar empirical methodology employed in of recent studies on Australian household longitudinal data.[2] Hence, the main focus of the study is on the link between the permanent component of labour income risk and the domestic economy's exposure to international competition. The focus on the permanent income risk is made because unlike the transitory income risk, workers would be less able in mitigating the shock and thus the potential welfare consequences of permanent income

[2] The labour income risk estimation part of the methodology follows those of earlier studies such as Carroll & Samwick (1997), Gourinchas & Parker (2002), and Meghir & Pistaferri (2004).

shocks are likely to be more significant. For example, workers may be able to reduce the impacts of transitory risks by smoothing their consumption overtime through savings or borrowings. In addition, there are public or private unemployment insurance schemes that, as in the case of consumption smoothing, reduce any transitory shocks to labour income risk.

To our knowledge, there is no existing study of the topic based on Australian data. The use of the Australian data to study the income risk – globalisation link allows us to make a number of important contributions to the literature. First, it provides us with the perspective of a small, open developed economy with less diversified export industry than the United States. With those characteristics, Australian workers may suffer more severe negative impacts of import competition in terms of increased income volatility. On the other hand, given that in Australia labour protection is (arguably) relatively strong, the negative impacts of globalisation on labour income volatility may be less severe. Second, the Australian data also allow us to investigate the differential effects between manufacturing and non-manufacturing sectors which may exist.

The findings of the study can provide important information for evaluating whether or not there is a need to better address the short-run adjustment to globalisation in order to minimize any associated welfare loss. There is strong evidence that globalisation can be associated with increased income inequality in both developed and developing countries. At the same time, increased globalisation can also be associated with domestic workers having to face higher economic uncertainty and volatility of their incomes and, therefore, a lower welfare even if there is no significant average income effect. If that is the case, the set of policies required to attenuate such

negative effects is likely to be different than the set of policies designed to attenuate the negative effects on income distribution. The rest of the report is structured as follows. Section 2 briefly reviews the literature on the link between international trade and labour income risk. Section 3 discusses the empirical methodology and the data. Section 4 presents the results. Section 5 concludes.

2. International Trade and Labour Income Risk

Economists generally agree that there is significant welfare benefit from international trade. However, many people are concerned with how increased trade from globalisation could negatively impact their job security (Felbermayr, *et al*. 2011). For example, many American workers fear that globalisation could worsen their prospects on the labour market (Scheve & Slaughter, 2001). To some extent such fear can rationalised (Felbemayr, *et al*. 2011). Those who lost their jobs because of trade liberalisation would need to spend some time actively searching before they could find new jobs. During this transition period, labour market reallocations increase the amount of frictions in the labour market resulting in even higher unemployment rate and longer transition time.

There is an extensive literature on the relationship between globalisation and income in the domestic economies. However, the main focus of the literature is on the mean income effects of globalisation rather than the effects on income volatility. Feenstra & Hanson (2002), Davidson & Matusz (2004), Goldberg & Pavcnik (2007), and Harrison (2007) provide a thorough survey of the literature and the summarised

research efforts have uncovered interesting and important findings on whether or not and how globalisation affects the level and distribution of incomes in the affected countries. They have been relatively silent with regards to whether or not and how workers' income uncertainty may also increase as a result of globalisation.

Recent studies such as Krishna & Senses (2009) and Krebs, *et al*. (2010) are particularly interesting because they investigated how globalisation may increase labour income risk. They argue that in theory there are a number of channels through which changes in trade openness may affect individual labour income volatility. First, as a country opens its border, its import competing sectors become more exposed to the volatility of the international markets. For example, responding to changes in international patterns of comparative advantage change, the domestic factors of productions in more open economies would need to reallocate across sectors and across firms further. If otherwise similar workers experience different outcomes of such reallocations, labour income uncertainty would increase (Fernandez & Rodrik, 1991).

Second, increased foreign competition may increase the demand elasticity of labour through the increased demand elasticity of products. In that case, shocks to labour demand would lead to a higher volatility in labour market outcomes (Rodrik, 1997; 1998; Traca, 2005). There are several studies which have tested for the impact of increased openness on the price elasticity of labour demand (see, for example, Hatzius, 2000, Bruno, *et al*., 2004, Riihimäki, 2005, Senses, 2006, and OECD, 2007 as cited in Molnar, *et al.*, 2008). They found that the demand for labour has become more elastic over time as a result. However, Molnar, *et al.* (2008) pointed out at the

possibility for two offsetting forces to work that both increase and decrease domestic labour demand elasticities such that ultimately it is an empirical question to resolve.

On the other hand, globalization may be associated with a lower level of individual income volatility if the international aggregation of shocks across countries resulted in a lower overall volatility. Furthermore, because the relationship may vary from country to country (for example, Haddad, *et al*. 2009 found that if a country has sufficient diversifications, trade openness would not increase output volatility), it is important to investigate the issue using individual micro data from many different countries.

Davidson & Matusz (2012) studied the link between labour market mismatch and globalisation — an issue that they argued to have received little attention. In the study they showed that the effects of globalisation on domestic labour market sorting can be ambiguous. This finding is important because, as argued by the authors of the study, there is a strong public belief that globalisation may lead to a break-down in the employer-employee matching process that can lead to workers being forced take "less than ideal jobs". Based on the finding, we may infer that, at least if income risk is a function of labour market sorting, the effects of globalisation on income risk are also ambiguous. If globalisation-displaced workers can find new jobs without any significant wage cut in a short period of time—that is if there is no significant sorting disruption, then the welfare implications of globalisation is not significant (Liu & Trefler 2011). In reality, Hummels, *et al*. (2010) found in their study of the Danish labour force from 1995-2006 that those workers displaced by offshoring experienced greater and more persistent income loss than workers displaced for other reasons.

We can expect that labour mobility plays a key role in how globalisation is linked to workers income (McCaig & Pavcnik 2012). There are several theoretical papers which built upon the work of Davidson, *et al.* (1988) in order to examine how trade affects labour market reallocation under institutional frictions (Menezes & Muendler, 2011). For example, Kambourov (2009) and Helpman, *et al.* (2010) found that labour reallocation after trade liberalisation depends on the characteristics of domestic labour market institutions such as firing costs and search frictions. However there is not much evidence with regards to how labour reallocates across firms in response to increased export opportunities arising from globalisation. It is possible that such reallocation counteracts the worker reallocation effects from increased import competition, leaving us with ambiguous effects on labour income risk.

The existing literature of the impacts of globalisation including studies which look at income risk is also still limited from the sectoral coverage point of few (Pavcnik, 2011). Almost all of the studies which look at the relationship between globalisation and income risk are based on workers data in the manufacturing sector only.[3] This is in part due to data availability. As discussed by Pavcnik in her survey of the literature, there is little empirical evidence on how trade in services affected wages due to the inherent difficulty in measuring services trade (Jensen, 2009) at the required detail level for empirical analysis. Another reason is the notion that the manufacturing sector is the traditional tradable sector and one may expect that manufacturing is the most

[3] Kletzer (2005) raised another important issue that a more realistic view to study the effects of globalisation is the one that realises the "importers" are often also the exporters. In the U.S., for example, electrical machinery and equipment, motor vehicles, and electronic computing equipment sectors are among the top exporters and importers. She believed there is no obvious way for knowing whether or not a given worker is trade displaced and the common view that "trade-related job loss is commonly understood to mean job loss due to increasing imports, and a trade-displaced worker is a worker for whom increased imports have contributed to job loss" is too simplistic.

sensitive sector with regards to globalisation effects. For example, Liu & Trefler (2011) found that globalisation's negative effect is more severe in the manufacturing sector because in the services sector worker sorting on unobservables is more important. However, the above arguments does not mean that we should ignore any potential negative effects of globalisation on workers' income risks in other sectors beside manufacturing because the manufacturing sector only accounts for less than 10% employment in many developed countries. Also, Pavcnik (2011) argued that since we expect services trade to continue growing, how such trade affects wages would stay as one of topics of future research.

For the case of Australia, there is not much that has been done on the relationship between globalisation and labour income risk. Relevant studies based on Australian data such as the study of Webber & Weller (2001) mostly belong in the group that looks at the income level effects. This is unfortunate because it has been found that the labour market is significantly rigid or if a high minimum wage is instituted, then the globalisation effects on labour income level and risk may be attenuated. The overall effects of globalisation may depend on the features of domestic labour markets. With significant labour market rigidities and binding minimum wage, one may expect a greater effect on the level of (un)employment and a smaller effect in terms of wage adjustment (Davis, 1998; Moore & Ranjan, 2005; OECD, 2005).

Given that in Australia labour protection is (arguably) relatively stronger than in the two countries studied earlier, the negative impacts of globalisation on labour income volatility may be less severe. However, Australia is also a small, open, developed economy with less diversified export industry than the United States. Hence, one may expect that Australian workers may suffer more severe negative

impacts on income volatility. On the other hand, McClaren & Newman (2002)—who modeled the effect of increased international openness on risk bearing when risk-sharing is instituted only via self-enforcing agreements—found that on balance, globalisation reduces risk and raises welfare for workers in small countries, but increases risk and reduces welfare for workers in large countries. All of these suggest that even for the case of Australia, how globalisation is related to labour income risk is still an open question.

3. Empirical Methodology and Data

Income risk

As discussed earlier, we apply a similar framework used by Khrisna & Senses (2009) and Krebs, *et al*. (2010) to estimate Australian workers' income risk using longitudinal data from a household survey. First, denote the log of labour income of individual *i* in industry *j* in time period *t* (month) by y_{ijt}. Then the earning equation for that worker can be specified as

$$y_{ijt} = \alpha_{jt} + \beta_t x_{ijt} + u_{ijt} \qquad (1)$$

where α_{jt} and β_t are time-varying coefficients, x_{ijt} is a vector of observed characteristics (age, gender, education, work experience, industry dummy, etc.), and u_{ijt} is a stochastic term of individual earnings representing changes to labour income that are not due to changes in observable characteristics (that is, u_{ijt} measures the extent of income risk). Notice that α_{jt} also varies by industry in order to capture any persistence industry level effect, however β_t is assumed to be constant across industries in order to save degrees of freedom.

Second, the income risk (the stochastic term, u_{ijt}) is assumed to be composed of two unobserved components as follows:

$$u_{ijt} = \omega_{ijt} + \mu_{ijt} \qquad (2).$$

The first 'error' component (ω_{ijt}) represents the permanent income risk (permanent shocks to income) and the second component (μ_{ijt}) represent the transitory shocks. In particular, we assume that the permanent income shocks are permanent because the shocks follow a random walk:[4]

$$\omega_{ij,t+1} = \omega_{ijt} + \varepsilon_{ijt} \quad (3)$$

where ε_{ijt} is independently identically distributed across time and individuals as $\varepsilon_{ijt} \sim N(0, \sigma_{\varepsilon j}^2)$. On the other hand, the transitory component is assumed to be independently identically distributed across time as $\mu_{ijt} \sim N(0, \sigma_{\mu j}^2)$.

Based on the above specifications, the estimates of $\sigma_{\varepsilon j}^2$ and $\sigma_{\mu j}^2$ provide us with the estimated magnitudes of permanent and transitory labour income risk faced by each individual worker in each industry *j*. Notice also that in equation (1) industry dummies are included as a control variable in x_{ijt}. This is to ensure that we control mean income changes and the associated volatility in the changes of the mean income of the industry. In other words, the risk estimates we obtain reflect idiosyncratic income risk experienced by workers

In order to estimate $\sigma_{\varepsilon j}^2$ and $\sigma_{\mu j}^2$, first note that from (2) - (3) the change in the residual of log income of individual *i* in industry *j* between period *t* and *t+n* is given by

[4] Given the limited time series in our data, in our empirical application we could not investigate other less restrictive "permanent" structures such as autoregressive and/or moving average structures instead of random walk.

$$\Delta_n u_{ijt} = u_{ij,t+n} - u_{ijt} = \varepsilon_{ij,t+1} + \cdots + \varepsilon_{ij,t+n} + \mu_{ij,t+1} - \mu_{ij,t+n} \quad (4)$$

and, its variance ($var[\Delta_n u_{ijt}]$) is given as

$$var[\Delta_n u_{ijt}] = \sigma^2_{\varepsilon j,t+1} + \cdots + \sigma^2_{\varepsilon j,t+n} + \sigma^2_{\mu jt} + \sigma^2_{\mu j,t+n} \qquad (5)$$

which, based on the distributional assumptions on μ_{ijt} and ε_{ijt}, equals to

$$var[\Delta_n u_{ijt}] = (2\sigma^2_{\mu j}) + \text{n } \sigma^2_{\varepsilon j}. \qquad (6)$$

In other words, the variance of income changes over the *n*-period is a linear function of *n* where the slope is equal to $\sigma^2_{\varepsilon j}$ and the intercept (and any unobserved random error in (6)) is $2\sigma^2_{\mu j}$.

For estimation, equation (6) can be estimated by regressing $var[\Delta_n u_{ijt}]$ (measured by the squared of income differences between periods *t* and *t+n* regardless of their employment status in any intermediate period) on the period *n.* The regression in (6) can be run for each industry separately to obtain estimates of the permanent component of labour income volatility faced by workers in each industry ($\sigma^2_{\varepsilon j}$). More importantly, with a long period panel data, we can divide the panel data into several sub-panel (denoted by *s*) and run the regression for subintervals of the data to obtain time-varying estimates of the permanent income volatility ($\sigma^2_{\varepsilon js}$).

GMM estimation of income risk

Another alternative to measure income risk that has been used in existing studies relies on the GMM estimation method. The crucial assumption in arriving at equation (6) is that income shocks ($\sigma^2_{\varepsilon j}$ and $\sigma^2_{\mu j}$) are time-invariant. A more realistic assumption is to allow them to vary overtime by applying a GMM estimation based on the moment conditions in equation (5). As described by Krebs et al. (2010) and used by Meghir & Pistaferry (2004) and Storesletten, *et al*. (2004), the equally weighted minimum

distance (EWMD) estimator of the time-varying income shocks can be obtained by minimizing

$$\sum_{t,n}\left(var\left[\Delta_n u_{ijt}\right] - \left(\sigma^2_{\varepsilon j,t+1} + \cdots + \sigma^2_{\varepsilon j,t+n} + \sigma^2_{\mu jt} + \sigma^2_{\mu j,t+n}\right)\right)^2. \quad (7)$$

Unfortunately, as in the case of Krishna & Senses (2009) and Hogrefe & Yao (2012), we do not have enough sample size to obtain reliable estimates of the annual industry level labour income risks using the GMM approach describe above. Hence, following earlier studies, we use the OLS approach described earlier and time variation of the risk is measured by splitting the sample into three sub-periods.

Effects of globalisation

Given the time-varying[5] estimates of permanent income volatility in industry j and sub-panel period s and the corresponding import penetration data ($M_{js} = imports/(shipment - exports + imports)$, we can specify a linear regression model incorporating both sectoral and sub-period fixed effects to estimate the impact of globalisation on labour income volatility:

$$\sigma^2_{\varepsilon js} = \delta_s + \delta_j + \delta_M M_{js} + \epsilon_{js}\ . \qquad (8)$$

The intuition to equation (8) is simply that we want to control for any time invariant sector wide effect that may determine industry level labour income risk while not wiping all industry-specific effects of the industries in the sector given that we only have data on the broader 2-digit classification and thus relatively low cross-industry variation. The time dummy is to control wider, time varying effects that may affect

[5] The time variation comes from variation across the subpanel. Permanent income risk is assumed to be constant within subpanel.

income risk such as macroeconomic fluctuations and other economic wide changes unrelated to time variation in import penetration.

The way equation (8) is specified means that there is a potential endogeneity bias in its estimation when import penetration is not fully exogenous to income risk, such as when it is a result of endogenous choice of trade policies (Krishna & Senses, 2009 and Krebs, *et al*., 2010). For example, a country with a strong labour union and a labour party government may implement a trade policy which protects more highly unionised industries which are at the same time more stable in terms of labour market outcomes fluctuations. Hence, it is crucial to include industry fixed effects so that δ_M is identified by the within-industry, rather than between-industry, variation. However, there is still another potential bias even with fixed effects estimation. For example, the government might set a higher level of import protection for an industry experiencing a higher intrinsic income risk. In this case, the fixed effects may not be adequate because the government responds to a change in income risk by changing the level of protection. However, if the government may increase import protection for industries experiencing increased labour income risk, then it also means a lower import penetration is associated with a lower income risk. In other words, the endogeneity bias goes against the hypothesis that globalisation increase income risk. Furthermore, there might also be bias arising from worker's self-selection bias (workers more tolerant to income volatility self-select into more import competitive industries) but again in this case the bias goes against the hypothesised positive link between import penetration and income risk. In fact, Krishna & Senses (2009) and Krebs, *et al*., (2010) argued that any form of unobserved endogeneity bias in equation (8) is mitigated by the use of the fixed effects and the fact that the distribution of workers within an

industry is not likely to be correlated with the variation in the level of import penetration. They also argued that there is little evidence that workers with different unobserved abilities tend to systematically self-select into industries according to different level of import penetration. This last point is evidenced by the lack of any systematic relationship between changes in unexplained portion of industry average wages and changes in import penetration.

Data

HILDA

The empirical estimation is based on a rich, Australian household panel database from the Melbourne Institute that was constructed using data collected from the annual Household, Income, and Labour Dynamics in Australia (HILDA) Survey over the period of 2001 – 2011. The HILDA Survey began in 2001 and its design followed those of household panel surveys in other countries as described in more detail in Wooden & Watson (2007). The sample of the survey is drawn from Australian households residing in private dwellings. There were as many as 7682 households interviewed in the first wave ('Wave 1') in 2001, with a response rate of 66%. In each sampled household, all eligible household members (aged over 15) form as the basis of individual panel to be followed in each subsequent wave. Overall, 92% of household members (13,969 individuals) responded to the interviews in Wave 1 and this sample size varies between 12,408 and 13,301 over the survey years due to deaths, non-responses, and the incorporation of new sample members.

More importantly for our purpose is that the HILDA data provide detailed information at the household and individual levels including wages, industry of

employment (2 digit classification), education, health and marital status, and number of children were collected at each wave. We can, for example, estimate labour income based on the survey's information on current weekly gross wages and salary for the main job and the hours worked per week in the main job (Watson, 2008). Because we are interested in estimating labour income risk and to facilitate comparison with other studies, we restrict the sample to males age 25-65 and females age 25-60. The different age range between male and female is to take into account the time age pension benefits in Australia becomes effective. In addition, as in Krebs, *et al*. (2010), we Winsorise the sample by dropping individuals with income below the 5^{th} percentile and above the 95^{th} percentile. After dropping observations with missing values in all dependent and independent variables, we ended up with a total sample size of 54,800.

Table 1 provides a descriptive summary of the sample. Slightly more than half of the individuals in our sample are males. Their average age is around 41 years old and, as in other developed countries, they completed around 13 years of schooling. In terms of labour market experience, our samples have on average 24 years of work experience and earn an average of income of around $37,667 in 2001-02 increasing to around $59,141 in 2011-12.

Table 1: Sample Descriptive Summary

		Wave 1: 2001-02			Wave 11: 2011-12		
		N	Mean	Std. Dev.	N	Mean	Std. Dev.
Male			53%	50%		52%	50%
Education	Number of schooling years		12,8	2,3		13,3	2
Age	Years		40,7	9,5		41,9	10,3
Work experience	Years after left school		24	10,1		24,4	11,1
Wages	Gross wages & salaries (year)		$37.667	$21.426		$59.141	$34.441
Sample size		5265			6340		
Resources (10)		276			279		
Manufacturing (15)		690			5417		
Services (50)		4299			6340		

Note: (): Number of industries within each sector.

Import Penetration

To measure the extent of import penetration, we use the input-output tables published by the Australian Bureau of Statistics (ABS 2006; 2008; 2012). These tables provide data on current values of imports and domestic production for 109 to 112 industries in 2001-02, 2004-05, and 2008-09. We compute import penetration as the share of imports to total domestic supply (import + Australian production). However, because the HILDA data only provide breakdown of 75 industries (most of which are in services), some aggregation of the industries are necessary. After a manual concordance between the two data sources, we have import penetration measures for 41 industries. The simple average of import penetration levels across these industries and the level for each industry within manufacturing are provided in Table 2.

Table 2: Import Penetration

.	2001-02	2004-05	2008-09	Δ2001-05	Δ2005-09
Resources	0,085	0,07	0,077	-0,015	0,007
Services	0,018	0,028	0,034	0,01	0,006
Manufacturing	0,254	0,268	0,305	0,014	0,037
Food, Beverage, Tobacco Mfg.	0,103	0,113	0,135	0,01	0,022
Textile, Clothing, Footwear, Leather Mfg.	0,439	0,56	0,559	0,121	-0,001
Wood, Paper Product, Mfg.	0,217	0,205	0,196	-0,012	-0,009
Printing, Publishing, Recorded Media	0,112	0,112	0,105	0	-0,007
Petroleum, Coal, Chemical Mfg.	0,332	0,372	0,391	0,04	0,019
Non-metallic Mineral Product Mfg.	0,144	0,12	0,133	-0,024	0,013
Metal Product Mfg.	0,106	0,131	0,131	0,025	0
Machinery, Equipment Mfg.	0,538	0,557	0,593	0,019	0,036
Other Manufacturing	0,292	0,37	0,502	0,078	0,132

Note: Import Penetration is defined as the proportion of imports as parts of total domestic supply.

From Table 2, across the periods, it appears the services industry had the least amount of competition from abroad. However, note that services industry's import penetration doubled during the decade, perhaps reflecting increased global trade activities in the services industry. The manufacturing industry is clearly the industry which received the highest level of import penetration (25.4 to 30.5 % over the period), at around 10 times the rates of penetration in services and 3 times the rates in resources industry. In other words, we may expect that if globalisation affects labour income risk, it would be more likely to be observed from workers in the manufacturing industry. Furthermore, within the manufacturing industry, textile and apparel, petroleum and chemical, machinery and equipment, and other manufacturing are the ones with the highest level of competition from imports.

The last two columns in Table 2 show the change in import penetration ratio between two adjacent sub-periods. First, over the 2001-09 periods, import penetration increased for the manufacturing and services sectors. In the resources (agriculture and

mining) sector, import penetration decreased by around 17 per cent between 2001-02 and 2004-05 and increased slightly between 2004-05 and 2005-09.

Another important point from Table 2 is that there is a significant cross-sectoral variation in the changes in import penetration ranging from a 17% decrease in resources between the first two sub-periods to a 56% increase in services in the same time period. However, the within sector cross-industry variation is not as high. For example, in the manufacturing sector, the changes in import penetration ratio range from a decrease of around 16% for non-metallic mineral products manufacturing in 2001-05 to an increase of around 35% for other manufacturing. Note also that the variation is even lower when we exclude industries with negative risk estimates as discussed later. What these mean is that if we use industry fixed effects instead of sectoral fixed effect in order to estimate equation (8), we might not have enough variation in our data to identify the effects of import penetration on labour income risk.

4. Results

Income Risk Estimates

Table 3 presents the estimated coefficients of the basic specification of the earning equation (equation 1) in which the β coefficients are constant over time in order to gauge the predictive power of the explanatory variables. The actual estimation of income risk will be based on a time-varying β and, for space consideration, the full set of time varying β coefficient estimates are not presented here.[6] What is important

[6] These results are available from the author upon request.

from Table 3 is that the sign of the coefficients estimates are as expected. Male workers are on average earning more than female workers. Similarly for older and more experience workers, reflecting their higher marginal productivity.

Table 3: Earnings Equation Estimates (Dep. Var = log (wage in last financial year))

	Coeff.	Std. Error
Male	0.381***	0,006
Married	0.047***	0,006
Union member	0.234***	0,006
Age	0.009**	0,004
Education	0.068***	0,004
Work experience	0.012**	0,005
Work experience squared	-0.004***	0
CONST	8.574***	0,099
Number of observation.	54800	
Adj.R^2	0,33	

Note: The regression allows for time varying slopes and interactions between time and industry; however, only the main effects are shown in the table. Also included in the regression are spoken English ability, number of dependents age 0-24, time, industry and state dummy variables. The symbol *** means the estimate is statistically significant at the 1% significance level.

In Table 4 we present the transitory and permanent income shocks estimates (and their associated standard errors) across industries for the three subpanels (2001-03, 2004-06, and 2007-09) computed based on the one-, two-, and three-period ahead of changes on the residuals of the estimated regression equation (1) for each individual worker in the sample. Note that those estimates for the sectors level (Resources, Manufacturing and Services) are simple averages of the industry level estimates within each sector.[7] From the table, we can see that income shocks vary across time and industry. As found in other studies, permanent income shocks are relatively much

[7] Also, note that the sector level standard errors are simple average of the standard errors of the industries within the sector.

smaller than transitory income shocks. However, it does not appear that permanent income shocks are larger on average in traditionally tradable sectors with higher import penetration rate such as Manufacturing. Finally, not that some of the shocks estimates are negative such as the permanent shocks estimate for Textile, Clothing, Footwear and Leather in 2004-06 (-0.0118). Earlier studies who used a similar approach also found negative risk estimates. While we do not know why this is the case, we can report that most of the negative estimates are not statistically significantly different from zero based on their standard errors. Later in our estimation of equation (8), we assess the sensitivity of our estimates by excluding industries with negative risk estimates.

Table 4: Income Shocks Estimates: Permanent and Transitory

	2001-03		2004-06		2007-09	
	Perm.	Trans.	Perm.	Trans.	Perm.	Trans.
Resources	0,0178	0,1333	0,0286	0,0594	0,0064	0,1742
	(0.0096)	(0.0116)	(0.0157)	(0.0143)	(0.0431)	(0.0225)
Services	0,0173	0,1557	0,0204	0,1046	0,0315	0,0838
	(0.0091)	(0.0114)	(0.012)	(0.0113)	(0.0255)	(0.0138)
Manufacturing	0,0113	0,1114	0,0128	0,0874	0,0318	0,0544
	(0.0075)	(0.0148)	(0.0112)	(0.0105)	(0.0263)	(0.0142)
Food, Beverage, Tobacco Mfg.	0,0032	0,1498	0,0136	0,0892	0,0286	0,05
	(0.0051)	(0.0062)	(0.0077)	(0.0072)	(0.0147)	(0.0081)
Textile, Clothing, Footwear, Leather Mfg.	0,0174	0,2331	-0,0118	0,2506	0,0536	0,0622
	(0.0181)	(0.0218)	(0.0271)	(0.0253)	(0.0441)	(0.0239)
Wood, Paper Product, Mfg.	0,0117	0,1718	0,0093	0,0745	-0,0127	0,1656
	(0.0118)	(0.0139)	(0.0112)	(0.0102)	(0.0403)	(0.022)
Printing, Publishing, Recorded Media	0,0138	0,0817	0,0318	0,0346	0,0554	0,0007
	(0.0062)	(0.0078)	(0.0113)	(0.0105)	(0.0216)	(0.0115)
Petroleum, Coal, Chemical Mfg.	0,0124	0,0622	0,0013	0,0948	0,031	0,0492
	(0.0054)	(0.0069)	(0.0083)	(0.0079)	(0.0241)	(0.0135)
Non-metallic Mineral Product Mfg.	0,0104	0,0354	0,0096	0,0125	0,0093	0,0446
	(0.004)	(0.0049)	(0.0028)	(0.0027)	(0.0136)	(0.0076)
Metal Product Mfg.	0,008	0,0468	0,004	0,0828	0,005	0,081
	(0.0033)	(0.004)	(0.0078)	(0.0072)	(0.0175)	(0.0097)
Machinery, Equipment Mfg.	0,0056	0,1502	0,0262	0,0782	0,006	0,0825
	(0.0053)	(0.0064)	(0.0089)	(0.0082)	(0.0141)	(0.0076)
Other Manufacturing	0,0188	0,0713	0,031	0,0693	0,1096	-0,046
	(0.009)	(0.009)	(0.0152)	(0.0152)	(0.0463)	(0.0243)

Note: Resources, Services and Manufacturing figures are simple average of the industries within each sector. The figures in the parentheses are the corresponding (average of) standard errors.

Table 5 provides a comparison of Australian labour income risk estimates in the manufacturing industries with those of the United States, Germany and Mexico as reported in earlier studies (Krishna & Senses, 2009; Krebs, *et al.*, 2010; Hogrefe & Yao 2012). Keeping in mind that the studies may use widely different estimation methods, measures of income and sampled individuals in estimating the risks, the

figures in Table 5 indicate that labour income risks in Australia is smaller than that of the US and Mexico. Perhaps this is an indication of a stronger role of labour union in Australia. Germany's estimates appear to be the smallest, especially the ones based on 1999-2005. It should be noted however that in the study "income" is measured by the (minimum) wage rate rather than actual take home income.

Table 5: Comparisons with Risk Estimates from Other Countries

	AUS 2001-2009		US 1993-2003	GER 1999-2005	1991-2005	MEX 1987-1998	
	Perm.	Trans.	Perm.	Perm.	Perm	Perm.	Trans.
Manufacturing	0,012		0,052	0,004	0,008	0,052	0,440
Food, Beverage, Tobacco	0,009	0,111	0,052	0,004	0,019	0,052	0,440
Textile, Clothing, Footwear, Leather	0,019	0,182	0,060	0,004	0,016	0,028	0,416
Wood, Paper Product	0,014	0,122	0,042	0,003	0,005	0,036	0,456
Printing, Publishing, Recorded Media	0,018	0,069	0,056	0,004	0,007	0,044	0,536
Petroleum, Coal, Chemical	0,001	0,076	0,047	0,003	0,010	0,040	0,380
Non-metallic Mineral Product	0,010	0,030	0,044	0,003	0,002	0,044	0,452
Metal Product	0,005	0,070	0,044	0,004	0,006	0,012	0,440
Machinery, Equipment	0,014	0,108	0,042	0,004	0,010	0,020	0,352
Other Manufacturing	0,021	0,087	0,084	0,004	0,000	0,020	0,572

Note: Germany (GER) estimates are simple averages of the estimates from Hogrefe and Yao (2012). Mexico (MEX) estimates are simple averages of annualised quarterly estimates from Krebs, *et al*. (2010). United States (US) estimates are simple averages of annualized monthly estimates from Krishna and Senses (2009).

Effects of globalisation

Table 6 summarises the coefficient estimates of the fixed effects model in equation (8). Unlike earlier studies, for the dependent variables we use both the industry level of permanent (Model 1A and 1B) and transitory income shocks (Model 2A and 2B) in order to assess whether or not transitory shocks are affected by globalisation to the

same extent.[8] The "All" sample estimates (Model 1A and 2A) show the effects of import penetration when we use all of the industries for which we have labour income risk estimates. The "Shocks>=0" sample estimates (Model 1B and 2B) exclude those industries which income shocks (variance in unexpected income change) estimates are negative. From the table, the results show weak evidence (at 10% significance level) that import penetration are positively related to labour income risk when measured using permanent shocks. However, the relationship is stronger when we exclude industries with negative shocks estimates.

Table 6: Effects of Globalisation: Three Sub-period Panel Data (2001-03, 2004-06, 2007-09)

Dependent variable:	**Permanent shocks**		**Transitory shocks**	
	Model 1A	Model 1B	Model 2A	Model 2B
Import penetration	0.121*	0.234***	0,177	0.259**
	(0.064)	(0.053)	(0.179)	(0.127)
CONST	0,006	-0,001	0.129***	0.128***
	(0.006)	(0.005)	(0.016)	(0.012)
Sample	All	Shocks>=0	All	Shocks>=0
N. Obs.	123	104	123	117
R^2 -within	0,146	0,395	0,251	0,259
R^2 -between	0,007	0,004	0,008	0,018

Note: All regressions include 39 to 41 industry fixed effects and two period dummy variables corresponding to 2004-06 and 2007-09. Robust standard errors are in parentheses. The signs *,**,*** denote statistically significant estimates at 1, 5, or 10% significance level respectively.

According to Model 1B's estimates in Table 6, on average, a one-percentage point increase in import penetration ratio (equivalent to slightly less than a ten per cent

[8] If they are affected significantly, then the efficiency of potential mitigating schemes that individuals can use becomes an important issue for policy consideration.

increase in average import penetration) is associated with an increase in permanent income risk from, for example, a cross-industry and cross-period average of 0.020 by 0.234. In standard deviation term, this is equivalent to a change from the 0.141 to 0.484. This is more than doubling in the standard deviation as a result of around 10% increase in import penetration is significant in magnitude. For comparison, Krebs, *et al*. (2010) found that a 5% reduction in tariff is associated with a 30% increase in the standard deviation of unexpected income change.[9]

To investigate cross-sector variation, we re-estimated equation (8) with the manufacturing and services industries separately. Table 7 summarises the estimation results for the manufacturing industries. As before, we estimate the models with and without industries with negative shocks estimates and for permanent and transitory shocks separately. For permanent shocks, the results strengthen our earlier findings. Higher import penetration is associated with higher permanent income risk. In contrast, the transitory shocks estimates have the opposite signs. We do not have any explanation for these surprising result; possibly it reflects the severely small sample we have and the fact that, by definition, the transitory risk estimates include measurement errors.

[9] If imports demand elasticity with respect to tariff is -1, with an average import penetration ratio of 12.5% in our data and assuming domestic output stays the same, the 10% increase in import penetration rate is equivalent to 20% of tariff reduction.

Table 7: Effects of Globalisation: Manufacturing Sector (2001-03, 2004-06, 2007-09)

Dependent variable:	**Permanent shocks**		**Transitory shocks**	
	Model 1A	Model 1B	Model 2A	Model 2B
Import penetration	0.360***	0.336***	-0.595***	-0.920**
	-0,08	-0,086	-0,165	-0,361
CONST	-0.096***	-0.088***	0.288***	0.386***
	-0,024	-0,025	-0,049	-0,105
Sample	All	Shocks>=0	All	Shocks>=0
N. Obs.	27	25	27	26
R^2 -within	0,591	0,714	0,459	0,366
R^2 -between	0,011	0,037	0,264	0,36

In Table 8 we present the coefficient estimates for the services industries only sector. Unlike in the case of the manufacturing industries, the results are more consistent with the whole economy estimates discussed earlier. Also, for services, it appears that transitory shocks are more important than permanent shocks. Furthermore, comparing the results in Tables 7 and 8, we can conclude that the relationship between import penetration and permanent income risk is weaker in the services sector.

Table 8: Effects of Globalisation: Services Sector (2001-03, 2004-06, 2007-09)

Dependent variable:	**Permanent shocks**		**Transitory shocks**	
	Model 1A	Model 1B	Model 2A	Model 2B
Import penetration	0,04	0.189***	0.414***	0.363***
	(0.042)	(0.054)	(0.092)	(0.08)
CONST	0.017***	0.019***	0.149***	0.159***
	(0.003)	(0.003)	(0.008)	(0.007)
Sample	All	Shocks>=0	All	Shocks>=0
N. Obs.	84	70	84	79
R^2 -within	0,142	0,306	0,456	0,48
R^2 -between	0	0,036	0,002	0,008

Note: All regressions include 28 industry fixed effects and two period dummy variables corresponding to 2004-06 and 2007-09. Robust standard errors are in parentheses. The signs *,**,*** denote statistically significant estimates at 1, 5, or 10% significance level respectively.

5. Conclusion

This study investigated the link between globalisation and Australian labour income risk, focusing on one particular aspect of globalisation namely international trade. Using individual level Australian longitudinal income data over 2001-2011, we estimated the extent of individual income risks measured as the variance of unexpected change in income in the next period.

We obtained both permanent and transitory income risk estimates from the residuals of a Mincerian income equation model for 41 two-digit Australian industries in the resources, manufacturing and services sectors. We then relied on within-industry variation to identify the relationship between import penetration and income risk by estimating fixed effect models of income risk.

We found statistically and economically significant evidence that increased import penetration is associated with increased permanent income risk. This relationship appeared to be robust across sectors. Also, the effects appeared to be stronger in manufacturing than in services.

However, for transitory shocks, the relationship is more mixed when we estimated the relationship for separate sector (that is, when we had a smaller sample size). We obtained a negative relationship for manufacturing and a positive one for services. We believed this might be due to the fact that in our model the transitory shocks estimates also captured measurement errors. Also, for services, the positive relationship between import penetration and transitory income risk appeared to be stronger than the relationship between import penetration and permanent income risk.

Policy implications

Unfortunately, our study did not investigate how specifically higher level of import penetration may lead to increased labour income risk. Hence, we are only able to make general policy inferences. First, while we do not perform any welfare estimation, based on the findings of other studies (Krebs, *et al*. 2010, Krishna & Senses, 2009) we expect the positive relationship between import penetration and labour income risk to have significant negative welfare consequences on Australian workers. As have been argued in this paper and earlier studies, this does not mean that there is no gain from trade and that Australia needs to shun itself away from global trade. Instead, it means that the country needs to be ready in anticipating such negative effects of globalisation in terms of increased transitory and permanent income risk by implementing policies that can mitigate them.

For trade liberalisation policy considerations, our findings that the negative impacts of globalisation may occur across sectors, including those in which import penetration is much less significance stress the importance for policy makers to pay attention to workers in all sectors regardless of their expected changes in the level of import penetration. When transitory shocks increase as a result of globalisation, the efficiency of existing market and non-market mechanisms which enable individuals to self-insure themselves against such fluctuations is important. Our results seem to indicate that this is particularly the case for workers in the services industries. On the other hand, for manufacturing, individuals' ability to cope when they are hit by permanent income shocks is more important. In this case, policies that mitigate labour reallocation effects by reducing the "down time" from employment are desirable.

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