The Effects of Temporary Foreign Workers on Firms' Hiring and Training Decisions

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ABSTRACT

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The presence of temporary foreign workers (TFWs) in Canada is a long-standing subject of political controversy. While there exists a significant body of economic research concerning the effects of TFWs on wages and unemployment, the effects of their presence on employers' training decisions have yet to be examined. In this paper, I will synthesize research on Canada's temporary foreign worker program and the literature on risks associated with human capital investments in order to develop a model of the effects of TFWs on employers' training and hiring decisions. I find that Canada's Temporary Foreign Worker Program may indeed allow employers to efficiently mitigate the hold-up problem in low-wage labour markets.

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1 Introduction

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The Canadian government announced changes to the country's existing Temporary Foreign Worker Program (TFWP) in the Spring of 2022. These included, increasing the cap for the hiring of Temporary Foreign Workers (TFWs) from 10% to 20%, and 30% for sectors with particularly severe labour shortages. Additionally, new sectors, such as food service and hospitality, in which employers had not previously been permitted to hire TFWs, could now do so under the 30% cap.[1] This cap increase was reversed by the Fall of 2024 with the Minister of Employment and Workforce Development citing declining vacancies and growing unemployment.[2]

According to the requirements of the TFWP, employers must pay TFWs a wage equivalent to that which they would pay a Canadian worker to perform the same tasks, which is referred to by the Canadian government as the "prevailing wage."[3] However, TFWs receive permits to work for a specific Canadian employer, and therefore do not participate in the Canadian labour market in the same sense as domestic workers.[4] (These are known as "closed" work permits.) Therefore, in spite of this rule, the hiring of TFWs may exert downward pressure on the prevailing wage (Brochu, Gross, and Worswick 2020), making it an attractive option to many employers as they may generate rents to human capital investments that they may not otherwise be able to capture in their entirety. The reluctance of

1. Employment and Social Development Canada, "Government of Canada announces Workforce Solutions Road Map – further changes to the Temporary Foreign Worker Program to address labour shortages across Canada," *Government of Canada*, last modified April 4, 2022, https://www.canada.ca/en/employment-social-development/news/2022/04/government-of-canada-announces-workforce-solutions-road-map–further-changes-to-the-temporary-foreign-worker-program-to-address-labour-shortages-ac.html.

2. Employment and Social Development Canada, "Minister Boissonnault provides next steps on recent changes to the Temporary Foreign Worker Program," *Government of Canada*, last modified September 18, 2024, https://www.canada.ca/en/employment-social-development/news/2024/09/minister-boissonnault-provides-next-steps-on-recent-changes-to-the-temporary-foreign-worker-program.html.

3. Employment and Social Development Canada, "Hire a temporary foreign worker in a low-wage position," *Government of Canada*, last modified June 19, 2023, https://www.canada.ca/en/employment-social-development/services/foreign-workers/median-wage/low/requirements.htmlh2.10.

4. Matt Lundy and Vanmala Subramaniam, "How Canada became a hotbed for low-wage foreign labour," *The Globe and Mail*, accessed July 21, 2023. https://www.theglobeandmail.com/business/article-tfw-program-canada-low-wages/.

employers to invest in human capital resulting from concerns over labour market risks and employee bargaining power is known as the hold-up problem. Canada's TFW program experienced significant year-over-year growth from 2021 to 2022.[5] Thus, it appears plausible that the hold-up problem is affecting an increasing number of sectors of the Canadian economy. Conversely, it should be noted that any employer will likely benefit from reducing turnover costs, irrespective of their ability to capture the return on their human capital investments, which complicates this picture.

Since most of the post-expansion uptake in the TFW program has occurred in its low-wage stream, designed to facilitate the hiring of foreign workers for low-wage (and increasingly relatively low-skilled) labour, it is unlikely that Canadian workers seeking jobs that may be filled through the this stream wield much bargaining power.[6] However, workers generally require some type of training after being hired so firms will nonetheless incur losses from investments in the on-the-job training of employees who quit unexpectedly. This paper will be focused on investigating the role of firm-sponsored on-the-job training (which will be referred to as training in subsequent sections of this paper for the sake of brevity) in driving demand for TFWs among a growing number of Canadian employers.

I will provide a synthesis between research on Canada's temporary foreign worker program and the literature on risks associated with human capital investments to better understand the specific economic conditions that make the use of TFWs problematic. While imposing higher costs for hiring TFWs (Gross 2014) or a cap-and-trade system on permits (the number of which would be reduced annually) (Lange, Skuterud, and Worswick 2022) would undoubtedly reduce the overall number of TFWs hired by Canadian employers by theoretically allowing only those most willing to pay to continue to do so, these solutions may inadvertently favour those most *able* to pay, which is not necessarily synonymous with economic efficiency.

The paper will begin with a brief review of the aforementioned literature, followed by the presentation of a theoretical model designed to demonstrate the importance of the training and turnover costs. Lastly, I will summarize the ideas presented in the preceding sections and make concluding remarks.

5. Matt Lundy "Temporary Foreign Worker program sees 68% jump in approvals," *The Globe and Mail*, accessed March 8, 2024. https://www.theglobeandmail.com/business/article-use-of-temporary-foreign-worker-program-soared-in-2022/.

6. This is an assumption based on the conditions for individual workers to wield hold-up power set forth by Bloesch, Larsen, and Taska (2022), which are unlikely to be met by low-skill workers.

2 Literature Review

In this section, I will present an overview of relevant contributions to the body of research regarding the hold-up problem with respect to firm-sponsored training, as well as the main contributions on the effects of the Temporary Foreign Worker Program (TFWP) on Canadian labour markets. Subsequently, I will discuss commonalities that exist in the literature on TFWs in Canada and the need for further research. I propose that the hold-up problem is a useful theoretical framework, to this end.

2.1 Training Investments and the Hold-up Problem

Training is an important source of economic growth as it improves a firm's efficiency by bolstering its stock of human capital. However, unlike other types of investments, human capital carries additional risks, most of which are related to the *human* component. While any investment will ideally generate rents, training can put another economic agent, the trained employee, in a position to capture some proportion of the return from the investor. For this reason, firms are often reluctant to finance training, as they are wary of the incentives of their employees.[7] Hence, the hold-up problem is a widely recognized culprit for the under-provision of training (Acemoglu and Pischke 1998; Chéron and Rouland 2011; Malcomson 1997). However, the circumstances under which hold-up will arise in labour markets, as well as mechanisms that can be used to overcome it, remain points of contention. The following is brief summary of a few seminal works on this topic as well as some more recent contributions to the literature.

The literature on the hold-up problem in labour markets begins with Becker (1962), who formalizes earlier observations about which agents bear the costs of training and the economic reasons for which they do so. Becker (1962) provides a general theoretical framework through which one can examine the under-provision of certain types of training. Arguing that only individual workers (not firms) will be willing to pay for their own general training (training that is equally valuable at any firm), Becker (1962) shows that in a perfectly competitive labour market, firms will pay for the training of their employees in proportion of the extent to which it is firm-specific, implying that training investments are motivated by rent seeking.

Acemoglu and Pischke (1998) challenge Becker's (1962) seminal work on the provision of training by providing an alternative theoretical model wherein all training is general, and layoff and quitting decisions are endogenous, by accounting for the possibility of asymmetric

7. Shapiro and Stiglitz (1984) note that any contract of employment represents a contested exchange since work effort is imperfectly observed by employers. I will address this observation later, but for now, it should be noted that training cannot resolve this problem since it does not increase work effort nor an employer's ability to supervise it.

information. They demonstrate that monopsony power incentivizes firms to invest in general training by discouraging quits while also providing an informational advantage in the second-hand job market. In other words, Becker (1962)'s result is contingent on the existence of perfect information in labour markets. Acemoglu and Pischke (1998) support their theoretical result by providing evidence from the United States, where quits are relatively high and training relatively low, and Germany, where the inverse is true.

Acemoglu and Pischke (1998) defend the reasoning behind their assumption that all training is general, by asserting that it shows that their findings regarding cases wherein firms will pay for training are independent of firm-specific human capital. However, their results differ slightly from those of Bloesch, Larsen, and Taska (2022), who use an O-ring production function to model individual worker hold-up power.[8] They assert that workers have hold-up power when they possess position-specific skills in firms where labour is differentiated into distinct tasks between which there exists complementarity. Additionally, Bloesch, Larsen, and Taska (2022) present empirical evidence in support of this result and assert that differences in wage premia (i.e. rents to employment captured by workers) can be largely attributed to the amount of hold-up power wielded by individual workers.

In spite of a general concurrence in the literature suggesting that the hold-up problem is driving the under-provision of on-the-job training in some labour markets, possible forms of market intervention have not been intensively explored. A notable exception is Chéron and Rouland (2011), who develop a theoretical matching model of job search and hiring wherein all training is specific per Becker's (1962) definition. They treat training as a hiring cost and assert that matches occur if and only if there are rents to employment over which to bargain. Since rents are distributed according to the bargaining power of both parties, training levels and the number of job destructions (separations) can be inefficient. Chéron and Rouland (2011) also use their model to show that this hold-up can be mitigated through training subsidies and firing taxes, implying that there is indeed a role for government in labour markets where this problem is prevalent.

A significant amount of research has been devoted to the hold-up problem as it pertains to training, yet it is also clear that economists are far from a consensus on how it may be overcome. Malcomson (1997) suggests that bargaining processes and fixed contracts may be viable options in some cases whereas Chéron and Rouland (2011) underscore the necessity of training subsidies and firing taxes. And while Acemoglu and Pischke (1998) show that

8. The O-ring production function, developed by Kremer (1993), is multiplicative and allows for the definition of the production process in terms of separate tasks, such that output is equal to the geometric sum of successfully completed tasks. It can also be modified, as shown by Bloesch, Larsen, and Taska (2022), to allow for variation in the complementary of tasks, which implies that the non-completion of some will incur a greater loss than that of others.

the hold-up problem is less prevalent where labour mobility is lower, they caution that this outcome may not be socially desirable as it may limit wage growth by lowering workers' abilities to capture rents to employment. In short, despite the progress made since Becker's (1962) initial contribution, more research is required to develop effective means of overcoming the hold-up problem with respect to training investments.

2.2 TFWs in Canada

Economists seem largely in agreement that Canada's Temporary Foreign Worker Program (TFWP) has negatively impacted low-skill Canadian workers. Brochu, Gross, and Worswick (2020), Cardoso et al. (2023), Gross (2009), Gross (2014) and O'Donnell and Skuterud (2022) all find evidence of growth in the low-skill stream of the TFWP that is commensurate with unemployment growth or wage stagnation among resident low-wage earners. Conversely, there are significant differences in the research methodologies that have been utilised to identify the precise causes of these observed effects and necessary policy responses to address them. The commonality between the existing approaches is a tacit dismissal of the importance of human capital costs with respect to the motivation of demand for TFWs. As I shall discuss later, the low-wage streams of the TFWP have been correctly identified as the most problematic, however, existing analyses are limited by the assumption that low-wage labour is effectively untrained.

Gross (2009) adopts the framework of Blanchard et al. (1992) to analyze the effects of the presence of TFWs on regional demand for employment. The model—a system of equations representing short-run labour demand, a wage-setting relation, labour supply and long-run regional labour demand, respectively—yields a positive correlation between regional unemployment and the employment of TFWs. Moreover, Gross (2009) attributes this relationship to the TFWP's inhibition of the neoclassical price adjustment mechanism that would typically mitigate regional disparities in unemployment through the movement of labour. Gross (2009) validates this theoretical result by using a semi-structural model to demonstrate a correlation between the 2002 expansion of the TFWP and growth in disparities in provincial unemployment rates, having first confirmed each province's equilibrium unemployment rate.

Brochu, Gross, and Worswick (2020) conduct a similar analysis of the effects of the TFWP on the wages of low-skill resident workers (the term used by Gross (2014)).[9] They analyze the wage effects of the presence of temporary foreign workers using a wage-efficiency model, wherein it is assumed that an individual's work effort is a function of their wage and the outside offers available to them (increasing in the former and decreasing in the latter).

9. This research question is similar in the sense that Gross (2009) suggests that the TFWP impedes demand-driven wage adjustments to fill vacancies.

Since it is highly likely that TFWs, as opposed to resident workers, have lower outside offers relative to their wage, Brochu, Gross, and Worswick (2020) suggest that resident workers must meet a higher productivity threshold in order to be hired for a given job. In other words, firms are more likely to hire a TFW at a given wage then they are a resident worker whom they believe to be equally productive. Thus, while temporary workers who migrate to Canada under the TFWP must be paid the same as residents,[10] employers have an incentive to exploit TFWs' relatively low outside offers by offering what Brochu, Gross, and Worswick (2020) call a "compromise wage"; that is, a legal wage that is above the outside offers of TFWs but likely below the reservation wages of comparable resident workers.

This result is supported by a regression model that estimates the differences in wages, turnover and hours worked (Brochu, Gross, and Worswick (2020) use this as a proxy for work effort) between resident workers and TFWs while accounting for various worker and industry characteristics. Brochu, Gross, and Worswick (2020) find that TFWs tend to have significantly lower wages and work longer hours. They also find that TFWs are more likely to stay with the same employer (which Brochu, Gross, and Worswick (2020) argue is in keeping with their hypothesis that TFWs are more wage-efficient) but find no statistically significant differences in quit rates among the two groups. This is perhaps indicative of a preference among employers to hire workers with little bargaining power, who supply labour inelastically, under the assumption that TFWs, due to the restrictive nature of their work permits, are more likely to do so at a given wage than resident workers. Brochu, Gross, and Worswick (2020) attribute this result to firms laying off their least wage-efficient employees first in response to a shock, but they do not address the asymmetry in the opportunity cost of quitting between TFWs and resident workers, nor the fact that TFWs often go into debt traveling to Canada and must use their earnings to pay it off.[11]

While, Gross (2009) and Brochu, Gross, and Worswick (2020) provide important theoretical insights, it is also useful to have more precise empirical details about the evolution of Canada's TFWP. O'Donnell and Skuterud (2022) use Immigration, Refugees and Citizenship Canada (IRCC) and Labour Force Survey (LFS) data to catalogue this evolution between the years 2000 and 2019, addressing a series of questions mostly pertaining to the penetration ratio of TFWs in the Canadian labour economy. They find that during this period, TFWs' overall share of the workforce increased (as did the average length of their

10. Not all temporary foreign workers in Canada are hired under the TFWP; some (most, in recent years) are hired under the International Mobility Program (IMP). This distinction is important because unlike the TFWP, the IMP does not require employers to offer the same wage they advertised to Canadian workers.

11. Tomoya Obokata, "Visit to Canada: Report of the Special Rapporteur on contemporary forms of slavery, including its causes and consequences," *United Nations Human Rights Council*, accessed October 4th, 2024. https://documents.un.org/doc/undoc/gen/g24/120/97/pdf/g2412097.pdf

work permits), with the majority of this growth being driven by TFWs with permits that were exempt from Labour Market Impact Assessments (LMIAs) and concentrated in low-skill occupations.[12] O'Donnell and Skuterud (2022) also use a linear regression model to show that TFW entrants, as a share of the Canadian labour force, are positively correlated with the ratio of vacancies to unemployed workers across all North American Occupation Classification (NOC) skill levels, but caution that this data is only observable for TWFs whose employers were required to obtain a positive LMIA, and that these workers have become the minority among new entrants since the program's 2013 reforms. Lastly, O'Donnell and Skuterud (2022) estimate transition rates to permanent residency using time series data from 2006 to 2019.[13] They find that the rate doubled during this interval. This result is somewhat perplexing in the context of Brochu, Gross, and Worswick's (2020) analysis, in which they find that TFWs are relatively more likely to stay with an employer, while asserting that employers are incentivized to hire TFWs due to their lower outside offers, resulting in higher wage-efficiency.[14]

Cardoso et al. (2023) undertake a narrower empirical examination of whether the TFWP has had a statistically significant impact on the wages of low-skill resident workers. They treat data from Canada's Longitudinal Immigration Database and the Canadian Employer-Employee Dynamics Database from 2010 to 2017.[15] Using an OLS regression (controlling for fixed effects such as industry, province, etc.), they find that the wages of low-skill workers were negatively correlated with the presence of TFWs at their firms. They also find that this correlation did not exist with respect to workers employed in the agricultural industry and that the earnings of high-skill workers were positively correlated with their firm's employment of TFWs (indicating complementarity). Cardoso et al. (2023) run this regression twice—once over sample data prior to the TFWP's 2013 reforms (2010 to 2013), and once over the sample data that followed their implementation—and find that the results from both periods are consistent with one another. The authors are clear that they are not able to infer causal relationships on the basis of this analysis, but the results they obtain seem to reflect the theoretical conclusions of Brochu, Gross, and Worswick (2020) and Gross (2009). Some empirical results regarding the hiring of TFWs and its effect on domestic wages (such as

12. The LMIA process is administered by Employment and Social Development Canada, and entails the evaluation of the prospect of a TFW hire negatively impacting resident workers. Additional fees and requirements have been periodically added to this procedure in response to public scrutiny of the TFWP (Gross 2014).

13. The author's assume that transition rates between Markov states—temporary residency, permanent residency and leaving Canada—are unchanging over time.

14. It seems plausible that this estimate, based on an aggregation of TFWs in Canada, is masking industry-specific differences in transition rates.

15. The latter is not publicly available because it consists of SIN-level data from workers in Canada.

those pertaining to high-skill domestic workers and those in agriculture) may owe themselves to skill complementarities between worker types. While this topic is somewhat beyond the scope of this paper, theoretical frameworks such as that proposed by Behrens, Duranton, and Robert-Nicoud (2014) could perhaps be adapted for future research in this area.

Gross (2014) [16] provides additional commentary on the 2013 reforms to the TFW system in the context of its recent history and international examples of similar programs. This is supplemented with a difference-in-difference analysis of the Expedited Labour Market Option (LMO, which has since been renamed LMIA) pilot project administered in Alberta and British Columbia between 2007 and 2010, wherein LMO applications were fast-tracked and made less demanding for employers. Gross (2014) finds that unemployment in Alberta and British Columbia grew at about three times the pace that it did (on average) in the rest of Canada during this period. Accordingly, Gross (2014) recommends that further policy changes be made so that employers are required to provide more detailed information and the cost barriers of accessing TFWs relative to resident workers be higher, adding that the latter should also be proportional to the size of firms seeking LMIAs.

In a more recent article, responding to the 2022 loosening of restrictions on TFW hires, Lange, Skuterud, and Worswick (2022) suggest that the IMP in particular is being used increasingly as a long-term measure to maintain low labour costs, which contradicts the stated goals of the program. They argue that allowing firms to hire more TFWs when the labour market is tight disincentivizes innovation and inhibits wage growth, thereby hurting productivity and contributing to further growth in income inequality. As an alternative to the current processes for hiring TFWs, Lange, Skuterud, and Worswick (2022) argue that a cap and trade system of hiring permits should be implemented so that firms can benefit from the program while remaining incentivized to become more efficient. They go further to suggest that the number of permits be reduced on an annual basis so that Canada can gradually reduce its reliance on the program until it is no longer dependent on migrant labour. This argument appears to somewhat contradict Gross's (2014) suggestion that application costs be made proportional to firm size to avoid overly-penalizing smaller firms that are less able to afford higher labour costs and/or carry-out intensive searches for candidates.

2.3 Commonalities and Need for Further Research

While different researchers have reached a variety of different conclusions regarding the effects of the presence of TFWs on the job market outcomes of resident workers, there appears to be a general consensus that the former has stifled the wage growth of the latter by undermining

16. The same Gross as Gross (2009) but not to be confused with Gross of Brochu, Gross, and Worswick (2020).

employers' incentives to pay premiums in order to attract candidates. Another aspect that seems to be shared by these contributions to the literature on this topic is a tacit dismissal of the possibility of training-related incentives driving firms' demand for TFWs.[17] It is worth noting, in the context of models like that of Brochu, Gross, and Worswick (2020), that in reality, employers can only partially observe a candidate's personal characteristics (such as their productivity or likelihood of quitting) before hiring them, which makes the sinking of human capital into a worker inherently risky. This may be especially true in low-wage labour markets, depending on the probability that a given worker has a competitive outside offer available to them. Therefore, it seems reasonable to consider the possibility that firms may also be attracted to TFWs because they believe them to represent a lower-risk investment of human capital.

Whether or not this is true, it is a worthwhile area of further research since some (Lange, Skuterud, and Worswick 2022) envision an eventual phasing-out of TFWs, while others (Gross 2014) see them merely playing a reduced role in the Canadian labour market. It should also be noted that this line of reasoning regarding the relative riskiness of TFWs has been used in the past by employers, arguing that access to TFWs is essential to the survival of their industry.[18] Moreover, this topic is important since there is evidence that the additional 'reliability' that may be associated with hiring TFWs is exploitative in nature.[19] I will subsequently develop a model, drawing largely from the work of Brochu, Gross, and Worswick (2020), to shed light on what an appropriate role for TFWs in Canadian labour markets could resemble, from a hold-up problem perspective.

3 The Basic Model

In the basic model, there is a single firm which domestic workers and TFWs to produce output. The workers decide the level of work effort that they will supply for a given wage rate. Workers differ by type—domestic or TFW—in their disutility from work effort. The firm accounts for the worker's optimal effort when deciding the wage rate as well as the allocation of workers across jobs. I start by considering a frictionless environment without

17. Lange, Skuterud, and Worswick (2022) dismiss this possibility explicitly, stating "[published] lists of employer approvals in the low-wage stream of Canada's temporary foreign worker program reveal that these are overwhelmingly jobs requiring no more than short periods of on-the-job training."

18. Jordan Gill, "At least 2,000 acres will go unplanted without foreign workers, say N.B. farm groups," *CBC News*, accessed October 4, 2024. https://www.cbc.ca/news/canada/new-brunswick/food-supply-collapse-workers-1.5578534

19. Tomoya Obokata, "Visit to Canada: Report of the Special Rapporteur on contemporary forms of slavery, including its causes and consequences," *United Nations Human Rights Council*, accessed October 4th, 2024. https://documents.un.org/doc/undoc/gen/g24/120/97/pdf/g2412097.pdf

search frictions.

3.1 The Worker's Problem

The first step of building the model described above is to define the worker's utility maximization problem. If it were impossible for workers to shirk or otherwise avoid fulfilling their contract in its entirety, due to either competing offers of employment or the disutility of work itself, then the hold-up problem would not exist. Thus, we must develop a model to describe the decision rules that workers use to determine the level of work effort they are willing to supply to a firm for a given wage.

It is assumed that Utility, $U(\cdot)$, is increasing and concave in consumption, c, and that $c = e \cdot w$, where w denotes the wage paid to the worker, and e denotes work effort. Furthermore, the form of the indirect utility function is assumed to be the following:

$$U(e, w) = c - \rho \cdot \frac{e^{1+\delta_h}}{1+\delta_h}$$

where e denotes work effort supplied, and $\delta_h > 1$ and δ_h varies by worker type, $h = \{d, f\}$, $\delta_d \neq \delta_f$, with d and f indicating domestic workers and TFWs, respectively.[20] Note that ρ is merely a scaling parameter.

Standard wage efficiency theory suggests that the workers who face higher costs associated with losing their job will supply more work effort (they are less likely to shirk). (Shapiro and Stiglitz, 1984, Yellen, 1995) In this sense, the difference in the wage rigidity of work effort between domestic workers and TFWs could be attributed to a number of plausible drivers. The most obvious among them are the constraints imposed by closed work permits: a TFW who quits their job in Canada on a closed work permit could face deportation or be forced to illegally accept informal employment.[21] Additionally, the due to the cost barriers associated with migrating for employment, one may reasonably infer that TFWs face far poorer job prospects in their home countries, which would increase the opportunity cost of shirking while working for a Canadian employer. Indeed, many TFWs in Canada (the majority of TFWs in certain industries) originate from countries where the cost of living and wages are comparatively low. (Falconer 2020) In some cases, the total economic cost of migration to a worker is raised further if they incur debt—as they often do—while traveling to Canada.[22]

20. It will be subsequently shown that δ_h is equal to the inverse supply elasticity of work effort.

21. Tomoya Obokata, "Visit to Canada: Report of the Special Rapporteur on contemporary forms of slavery, including its causes and consequences," *United Nations Human Rights Council*, accessed October 4th, 2024. https://documents.un.org/doc/undoc/gen/g24/120/97/pdf/g2412097.pdf

22. *Ibid.*

With the above assumptions, the worker's utility maximization problem may be defined as follows:

$$\max_{c,e}\{U(e,w)\}, \text{ subject to } c = e \cdot w.$$

Its solution is given by

$$e^*(w) = \left(\frac{w}{\rho}\right)^{\frac{1}{\delta_h}}, \tag{1}$$

which is equivalent to the worker's best response to wage offer, w, and indeed, their optimal supply of effective labour or work effort.[23] Note that e_h^* is increasing and concave in wages, w, since $\delta_h > 1 \,\forall\, h = \{d, f\}$ by assumption.

It should also be noted that this is not a standard labor-leisure model: e represents work effort, not work hours supplied or forgone hours of leisure time. In this model, work effort effectively serves as a proxy for the degree of contract completion. It is a mathematical representation of the fact that employment is a form of contested exchange since work effort is imperfectly observed by employers (Shapiro and Stiglitz 1984). In this case, however, it is tacitly assumed that firms have some understanding of how the level of work effort supplied will differ by worker type.

From Equation (2), we may define the Frisch wage elasticity of the supply of effective labour (or work effort):

$$\eta_h = \frac{\partial\, e_h^*}{\partial\, w}\frac{w}{e_h^*} = \frac{1}{\delta_h}.$$

This implies that wage rigidity, η_h^{-1}, is increasing in δ_h, and that work effort is supplied inelastically by both worker types (since $\delta_h > 1$ for all $h = \{d, f\}$) for all model specifications for which there exist an interior solution.[24]

Now that we have established a rationale for how workers determine their optimal level of work effort supplied, and how they differ by type, in this regard, we may construct a model of the process through which firms determine the optimal wage to pay a worker, according to their type.

23. This best response implies a convex indirect wage utility function, which is a normal property of the preferences of risk-neutral agents. Workers in this model are implicitly risk-neutral since $U(\cdot)$ is linearly increasing in c. See Appendix for derivation of solution.

24. An inelastic labour supply is indeed a necessary condition for an interior solution.

3.2 The Firm's Problem

In this section, I will present the general reasoning that informs the model developed in this paper. Initially, I will present a version of the model without training—similar to that developed by Brochu, Gross, and Worswick (2020)—to show the basic mechanics of the model, and elaborate a modified version, that includes firm-sponsored training, in a subsequent section.

As established in Section 3, individual workers supply an optimal level of work effort, e_h^*, to a profit-maximizing firm, which is a best-response to any wage, w, in accordance with their preferences. It should also be noted that 'work effort supplied,' in this model, is used as a proxy for the probability of a worker completing their contract. Therefore, it will also be assumed that $e^* \in (0, 1)$.[25]

Firms wish to optimally allocate workers of types d and f, to jobs, $j = \{1, 2, ..., n\}$, which vary in their inherent productivity levels. Brochu, Gross, and Worswick (2020) use the following reduced-form profit function in their wage efficiency-based analysis of hiring decisions in the presence of TFWs:

$$\pi(j, h, w) = g(\alpha_j, e(w)) - w$$

where $g(\cdot)$ denotes the output produced by an individual worker, α_j, the inherent productivity of job j, and $e(\cdot)$, a worker's supply of work effort. [26] The following profit function will be adopted for the purpose of this analysis:

$$\pi(j, h, w) = g(\alpha_j, e(w)) - e(w) \cdot w \tag{2}$$

While this formulation does weaken the notion of wage efficiency in the context of this model, the term $e \cdot w$ (as opposed to w) is necessary to ensure the profit functions consistency with the worker's utility function. Any specification of a utility function that would avoid this issue, while satisfying all of the other desired properties discussed above, would imply that the worker's optimal supply of effort is zero. This may explain why Brochu, Gross, and Worswick (2020) do not provide a utility function from which a worker's optimal supply of effort is derived. In addition, it can easily be shown that this model will yield the same results as those obtained from Brochu, Gross, and Worswick's (2020) formulation if the production function is also modified, such that it is increasing and concave in $e(w)$ as opposed to

25. This assumption is, however, easily relaxed without affecting the characterization of the equilibrium.

26. One could also specify a production function $g(\alpha_j, e(w, u_h))$, where u_h denotes a worker type's uniform next-best outside offer, such that δ_h is increasing in u_h.

increasing and linear.[27]

In the presence of TFWs, Brochu, Gross, and Worswick (2020) define expected profits from a hire as follows:

$$\Pi_j = P(w)\pi(j, d, w) + \beta(1 - P(w))\pi(j, f, w),$$

where β is a discount factor and $P(\cdot)$ is an increasing function in wages, w, with support $(0, 1)$, that denotes the probability that an employer will hire a domestic worker. Brochu, Gross, and Worswick (2020) also specify that $P'(w) > 0$ and $P''(w) < 0$. In keeping with Equation (4), this definition will be modified for the purpose of this analysis:

$$\Pi_j = P(w)\,\pi(j, d, w) + (1 - P(w))\,\pi(j, f, w). \tag{3}$$

The discount factor, β, is excluded from this reformulation for the following two reasons. First, if firms must commit to a particular wage, as required by the TFWP, then they will be interested in maximizing steady-state profits (Manning 2013).[28] Second, since this analysis is largely concerned with seasonal work, and the mandatory waiting period for employers who wish to hire a TFW is only four weeks, it seems unlikely that there would be a significant difference in the present value of the profits generated by equally productive domestic workers and TFWs.

The following definition of $g(\cdot)$ is adopted:

$$g(\alpha_j, e(w)) = \alpha_j \cdot (e(w))^{\phi},$$

where α_j denotes the some inherent productivity level of job j, and ϕ is a parameter to ensure a well-behaved solution.[29] Note that since e^* is a best response to any wage, w, we may rewrite the above definition as

$$g(\alpha_j, e(w)) = \alpha_j \cdot (e_h^*)^{\phi}. \tag{4}$$

27. Brochu, Gross, and Worswick (2020) specify the latter. See proof in Appendix.

28. It should also be noted that the presence of TFWs will distort the outcome of otherwise competitive markets. Therefore, a labour market in which firms may hire TFWs cannot be perfectly competitive. This notion will become clearer later.

29. ϕ ensures that $g(\cdot)$ in increasing and concave in work effort, $e(\cdot)$, although this could also be said to represent the its marginal factor productivity.

3.3 Optimal Wages

If it is assumed that no information is hidden from employers (perfect information), then they will know, by extension, the wage, w_h^*, that will ensure that any job, j, is filled by the type of worker, h, who may optimally do so. We may thus combine Equations (1), (2) and (3) to obtain the firm's employee output maximization problem:

$$\max_w \left\{ \alpha_j \cdot \left(\left(\frac{w}{\rho} \right)^{\eta_h} \right)^{\phi} - \left(\frac{w}{\rho} \right)^{\eta_h} \cdot w \right\}.$$

The solution to this problem is given by

$$w_h^* = \left(\alpha_j \cdot \phi \left(\frac{\eta_h}{1+\eta_h} \right) \right)^{\frac{1}{\psi}} \rho^{\frac{\psi-1}{\psi}}, \tag{5}$$

where

$$\psi = 1 + \eta_h(1-\phi),$$

and w_h^* denotes the optimal wage for workers of type $h = \{d, f\}$.[30]

It should be noted that w_h^* is increasing in the wage elasticity of effort; that is

$$\frac{\partial w_h^*}{\partial \eta_h} = w_h^* \left(\frac{1}{\psi} \left(\frac{1}{\eta_h} - \frac{1}{1+\eta_h} \right) + \frac{1-\phi}{\psi^2} \ln \left(\frac{(1+\eta_h)\rho}{\alpha_j \phi \eta_h} \right) \right) > 0.$$

While this result is rather intuitive since workers who are more sensitive to wages will be costlier (although not necessarily less profitable) to retain, it is important to show that a worker's propensity to shirk (under-provide work effort, $e(w)$) is increasing in η_h, and thus, the firm will seek to maximize the efficiency with which they discourage shirking. This implies that the workers who are the least wage-sensitive of the two worker types in this model will always receive a lower wage than their comparatively demanding counterparts. For this reason, one may also characterize η_h as deterministic of the bargaining power of a worker of type h.

Proposition 1: The existence of the finite interior solution w_h^* implies that there exists a finite interior solution for $\max_w\{\Pi_j(w)\}$.[31]

Corollary: The existence of the finite interior solution (w_h^*, τ_h^*) implies that there exists a

30. See Appendix for derivation of solution.

31. The definition of $\Pi_j(w)$ is given by Equation (3), such that $g(\cdot) = \alpha_j \cdot (e_h^*)^{\phi}$. See proof of Proposition in Appendix.

finite interior solution for $\max_{w,\tau}\{\Pi_j(w,\tau)\}$.[32]

Using the results established above, we can easily show that the productivity level of some job j is deterministic of the type of worker who may optimally fill it. Substituting w_h^* into $\pi(j,h,w)$ yields

$$\begin{aligned}\pi(j,h,w_h^*) &= g(\alpha_j, e_h^*(w_h^*)) - e_h^*(w_h^*)\cdot w_h^* \\ &= \alpha_j \cdot \left(\frac{w_h^*}{\rho}\right)^{\eta_h\cdot\phi} - \left(\frac{w_h^*}{\rho}\right)^{\eta_h}\cdot w_h^*.\end{aligned}$$

Hence, $\frac{\partial\,\pi(j,h,w_h^*)}{\partial\,\alpha_j} > 0$ and $\frac{\partial\,\pi(j,h,w_h^*)}{\partial\,\alpha_j \partial\,\delta_h} \neq 0$. This implies that there exists an inherent productivity level, α_j^*, such that $\pi(j,d,w_h^*) = \pi(j,f,w_h^*)$ since $\delta_d \neq \delta_f$. Put differently, α_j^*, denotes the inherent productivity level at which it is no longer profitable to hire a TFW over a domestic worker, due to the difference in their respective wage rigidities, $\eta_h^{-1} = \delta_h$. Therefore, the cut-off level (borrowing Brochu, Gross, and Worswick's (2020) terminology) of inherent productivity for firms to fill a job, j, with a TFW is exogenous, and the workers with the greatest wage rigidities will be optimally allocated to job types j such that $\alpha_j < \alpha_j^*$.

In short, the results presented in this section show that the optimal wage w_h^* is increasing in job productivity level α_j and elasticity of work effort η_h. Additionally, I have shown that α_j is deterministic of the type of worker who may optimally fill some job j. In the following section, I will provide a similar analysis of a case in which the firm-sponsored training that workers have received affects job productivity.

4 The Model with Training

This section consists of analysis of a case similar to that which preceded it, but where firms must determine an optimal level of training for some job, j, to deliver to a worker of type h (domestic or TFW). The assumption of perfect information will be retained from Section 4.

If we assume that the productivity of some job j is not given exogenously by α_j, but increasing and concave in employer-sponsored training, τ, we have

$$\begin{aligned}\pi(j,h,w,\tau) &= g(e_h^*(w),\tau) - e_h^*\cdot w - \overline{w}\cdot\tau \\ &= \beta\cdot(\tau_0+\tau)^\theta\cdot(e_h^*)^\phi - e_h^*\cdot w - \overline{w}\cdot\tau.\end{aligned}$$

Hence, we may rewrite the firm's employee output maximization problem (for the perfect

32. The definition of $\Pi_j(w,\tau)$ is given by Equation (3), such that $g(\cdot) = \beta\cdot(\tau_0+\tau)^\theta\cdot(e_h^*)^\phi$. This case is examined in Sections 5 and 6.

information case) as follows:

$$\max_{\tau,w}\left\{\beta\cdot(\tau_0+\tau)^{\theta}\cdot(e_h^*)^{\phi}-e_h^*\cdot w-\overline{w}\cdot\tau\right\},\text{ subject to }\theta,\phi\in(0,1),$$

and where

$$e_h^*=\left(\frac{w}{\rho}\right)^{\eta_h}.$$

This problem yields the following Euler Equation:

$$\tau_h=w^{1+\eta_h}\rho^{-\eta_h}\left(\frac{\theta}{\phi\cdot\overline{w}}\right)\left(1+\frac{1}{\eta_h}\right)-\tau_0, \tag{6}$$

which implies that training , τ_h,is increasing and concave in wages, w, since $(1+\eta_h)$ has support $(1,2)$.[33] The following should also be noted:

$$\frac{\partial\tau_h}{\partial\delta_h}=\frac{\theta w}{\overline{w}\phi}\left(\frac{w}{\rho}\right)^{\frac{1}{\delta_h}}\left(-\frac{1+\delta_h}{\delta_h^2}\ln\left(\frac{w}{\rho}\right)+1\right).$$

Since $\delta_h=\eta_h^{-1}$, we may conclude from this result that training, τ_h, is increasing in wage rigidity for low-wage jobs; that is, jobs such that $w<\rho$.[34]

Substituting Equation (10) into Equation (8) yields

$$w_h^*=\rho^{\frac{\eta_h[(\theta-1)+\phi]}{\gamma_h}}\cdot\left[\frac{\phi^{\theta-1}\cdot\overline{w}^{\theta}}{\beta\cdot\theta^{\theta}\cdot\left(1+\frac{1}{\eta_h}\right)^{\theta-1}}\right]^{\frac{1}{\gamma_h}}, \tag{7}$$

and thus,

$$\tau_h^*=(w_h^*)^{1+\eta_h}\rho^{-\eta_h}\left(\frac{\theta}{\phi\cdot\overline{w}}\right)\left(1+\frac{1}{\eta_h}\right)-\tau_0,$$

by Equation (6), where

$$\gamma_h=(\theta-1)+\eta_h[(\theta-1)+\phi].$$

In similar fashion to the case with exogenous human capital (no firm-sponsored train-

33. See Appendix for derivation of this condition.

34. While there are a variety of sets of model parameters that would satisfy the assumptions that have been made thus far, few will render a case wherein $e_h^*\in(0,1)$ and $w<\rho$.

ing), there exists a level of marginal factor productivity of human capital, θ_j^*, such that employers are indifferent with respect to the type of worker they would prefer to hire—that is, $\pi(j, d, w, \tau) = \pi(j, f, w, \tau)$—if the following two conditions hold: (1) for any θ_j, $\frac{\partial \pi(j,h,w,\tau)}{\partial \theta_j}$ and $\frac{\partial^2 \pi(j,h,w,\tau)}{\partial \theta_j^2}$ have the same signs (respectively) for both worker types, $h = \{d, f\}$, and (2) $\frac{\partial^2 \pi(j,h,w,\tau)}{\partial \delta_h \partial \theta_j} \neq 0$. These conditions are satisfied by definition of $\pi(j, h, w, \tau)$ since $\delta_d \neq \delta_f$ by assumption, but the the respective profit functions associated with each worker type are otherwise identical.

As noted earlier, training, τ_h, is increasing in wage rigidity, $\eta^{-1} = \delta_h$. Hence, if $\delta_f > \delta_d$, then it follows that firms would prefer to hire TFWs over domestic workers for all jobs, j, such that $\theta_j < \theta_j^*$, since they can be trained more efficiently, and therefore, more profitably. While firms could do the same for jobs above the 'cut-off,' this would result in unrealized profits from not offering these positions to comparatively wage-responsive domestic workers.

While the characteristics of the results obtained from this model specification are fairly similar to those obtained in Section 4, we can see that the elasticity of work effort may indeed impose constraints upon a firm's ability to viably train a worker for some job j and that different worker types may optimally fill different jobs. In addition, we can observe that the reasons for which firms may resort to hiring TFWs to fill low-margin jobs are more complex than they appear in a model in which training is nonexistent.

5 The Model with Training and Imperfect Information

The notion of a 'cut-off' level of productivity, established in Sections 4 and 5, is—as Brochu, Gross, and Worswick (2020) point out—a "naïve view" of the TFWP. To address concerns of upward pressure on unemployment, the TFWP requires firms applying for a permit to hire a TFW to submit proof that they have previously conducted a search effort for a domestic worker. Thus, for some job j that is optimally filled by a TFW, firms will be incentivized to advertise a particularly low wage, if they know TFWs to be less wage-sensitive than their domestic counterparts, since this will increase the probability of successfully matching a worker of the optimal type to that job.[35]

If we introduce job-search friction, $P(w)$, such that $P'(w) > 0$ and $P''(w) < 0$, as do Brochu, Gross, and Worswick (2020), and assume the absence of TFWs

35. It is important to note that work effort, in this model, effectively serves as a proxy for the degree of contract completion rather than an indicator of the wage premium required to attract a worker.

from the labour market, we may rewrite the preceding problem as follows:

$$\max_{\tau,w}\left\{P(w)\left(\beta\cdot(\tau_0+\tau)^{\theta}\cdot\left(\frac{w}{\rho}\right)^{\eta_h\cdot\phi}-\left(\frac{w}{\rho}\right)^{\eta_h}\cdot w-\overline{w}\cdot\tau\right)\right\}.$$

The first order conditions yield

$$P(w)\left(\beta\cdot\theta\cdot(\tau_0+\tau)^{\theta-1}\cdot(e_h^*)^{\phi}-\overline{w}\right)=0, \tag{8}$$

and

$$\begin{aligned}P'(w)\cdot\pi(j,h,w,\tau)+\\ P(w)\left(\beta\cdot(\tau_0+\tau)^{\theta}\left(\frac{\phi\cdot\eta_h(e_h^*)^{\phi}}{w}\right)-e_h^*(1+\eta_h)\right)=0.\end{aligned} \tag{9}$$

Equation (8) implies that a wage-premium, $P'(w)\cdot\pi(j,h,w,\tau)$, must be paid in order to ensure that a domestic worker is hired. Holding training costs, $\overline{w}$, and the marginal factor productivity of human capital, θ, constant, this diminishes the firm's ability to provide training, and thus, implies lower labour productivity and firm profits, relative to the perfect information case.

If we introduce TFWs to the imperfect information case, we may rewrite the above problem as follows:

$$\max_{\tau,w}\{P(w)\pi(j,d,w,\tau)+(1-P(w))\pi(j,f,w,\tau)\},$$

where

$$\pi(j,h,w,\tau)=\beta\cdot(\tau_0+\tau)^{\theta}\cdot\left(\frac{w}{\rho}\right)^{\eta_h\cdot\phi}-\left(\frac{w}{\rho}\right)^{\eta_h}\cdot w-\overline{w}\cdot\tau$$

for $h=\{d,f\}$.

The first-order conditions for this problem are given by

$$P(w)\cdot\frac{\partial\, g(e_d^*(w),\tau)}{\partial\,\tau}+(1-P(w))\cdot\frac{\partial\, g(e_f^*(w),\tau)}{\partial\,\tau}-\overline{w}=0, \tag{10}$$

and

$$\begin{aligned}P'(w)\cdot(\pi(j,d,w,\tau)-\pi(j,f,w,\tau))+\\ P(w)\cdot\frac{\partial\, g(e_d^*(w),\tau))}{\partial\, w}+(1-P(w))\cdot\frac{\partial\, g(e_f^*(w),\tau))}{\partial\, w}-1=0,\end{aligned} \tag{11}$$

where the production function for worker types $h = \{d, f\}$ is given by

$$g(e_h^*(w), \tau) = \beta \cdot (\tau_0 + \tau)^\theta \cdot \left(\frac{w}{\rho}\right)^{\eta_h \cdot \phi}$$

Note that $\frac{\partial\, g(e_h^*(w),\tau)}{\partial\, \tau}$ and $\frac{\partial\, g(e_h^*(w),\tau)}{\partial\, w}$ are equivalent to the marginal productivity of training, τ, and wages, w, respectively.

The terms $(1-P(w)) \cdot \frac{\partial\, g(e_f^*(w),\tau)}{\partial\, \tau}$ and $(1-P(w)) \cdot \frac{\partial\, g(e_f^*(w),\tau)}{\partial\, w}$ from Equations (10) and (11), respectively, imply increased productivity relative to the 'no-TFW' case, and a decreased wage premium in the order of $P'(w) \cdot \pi(j, f, w, \tau)$. Thus, as in the case of perfect information, expectations of productivity and profits are higher, and wages are lower in the presence of TFWs, if we assume that firms know that the work effort of TFWs is less wage-elastic than that of their domestic counterparts.

With the introduction of the job search friction $P(w)$, we can see that the 'Imperfect Information' case is not fundamentally different from those explored in Sections 4 and 5. However, the above results do imply that the presence of TFWs will invariably impose downward pressure on the wages of some domestic workers. Thus, there is indeed a welfare cost associated with filling jobs with TFWs, even if it is optimal to do so with respect to the maximization of profits and output.

6 Policy Implications

The costs and benefits of the TFWP, as well as its tendency to provoke political controversy warrant a policy discussion concerning the optimal management of the program. In order to inform this discussion, we must aggregate the effects of individual hires so that we may assess the effects of different policies on entire firms.[36] This section will be focused on the effects of fees and quotas, as these are the most frequently suggested means of curtailing the growth of the TFWP and the only two that have been implemented.

If we assume that for any wage, w, work effort supplied differs with worker type ($e_d^* \neq e_f^*$), then the firm's labour force output maximization problem is given by

$$\max_{w_j} \left\{ \sum_{j \in [j_0, j^*)} n_j\, \pi(j, f, w, \tau) + \sum_{j \in [j^*, \bar{j}]} n_j\, \pi(j, d, w, \tau) \right\},$$

where j^* denotes the job (which, of course, could be merely hypothetical) that corresponds

36. In this section, it is tacitly assumed that all firms within a given industry are identical such that a single firm is representative of an entire industry. I recognize that this is a strong assumption.

to the value of θ_j^*, n_j denotes the number of jobs of type j that the firm may profitably fill, and j_0 and $\overline{j}$ denote the least and most inherently productive jobs (respectively) in the latter category. We can conveniently represent this variation in productivity levels across jobs graphically, while abstracting away from labour composition effects, by assuming that the firm has only one job to fill for each type, j, and aggregating each set of jobs from the definition of the above problem as a unit-mass:

$$\int_{j_0}^{j^*} \pi(j, f, w, \tau)\, dj + \int_{j^*}^{\overline{j}} \pi(j, d, w, \tau)\, dj, \tag{12}$$

where each integral in the expression has support $[0, 1]$.

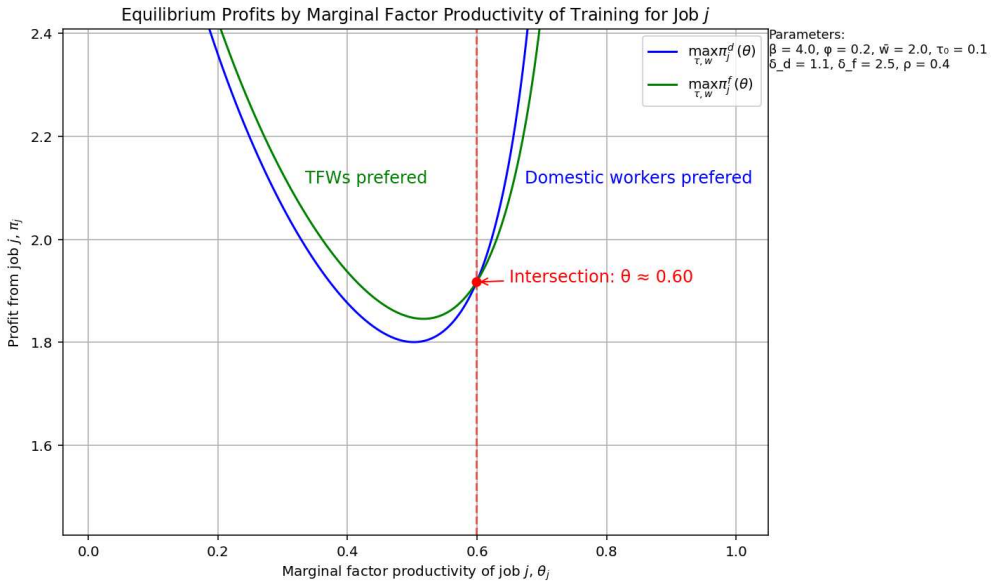

Figure 1: Variation in Equilibrium Profits with Marginal Factor Productivity, θ_j.

Canada's Temporary foreign Worker Program (TFWP) charges a fee to hire a TFW (which has been periodically adjusted over time), which adds an on-boarding cost to the profit function in this model, that would distort this outcome. In addition, firms are subject to a hiring cap on TFWs, which has also varied over time.[37]

6.1 Fees and Quotas

Suppose the TFWP charges a fee of k per individual TFW hire. This would shift the 'cut-off' level of inherent productivity to θ_j' which satisfies the identity $\pi(j, d, w, \tau^*) + k =$

37. Unlike a uniform fee of k imposed on all TFW hires, this is not necessarily a binding constraint for all firms who hire TFWs.

$\pi(j, f, w, \tau^*)$. While θ'_j cannot be explicitly defined, it is straightforward to see that $\theta^*_j > \theta'_j$ since $\pi(j, h, w)$, $h = \{d, f\}$, is increasing in θ_j. Therefore, assuming no jobs will be destroyed, a fee per TFW hire of value k will incur a dead-weight loss of

$$\begin{aligned} &\Bigg(\sum_{j \in [j_0, j^*)} n_j \, \pi(j, f, w, \tau) + \sum_{j \in [j^*, \bar{j}]} n_j \, \pi(j, d, w, \tau) \Bigg) - \\ &\Bigg(\sum_{j \in [j_0, j')} n_j (\pi(j, f, w, \tau) - k) + \sum_{j \in [j', \bar{j}]} n_j \, \pi(j, d, w, \tau) \Bigg) \end{aligned} \tag{13}$$

in firm profits, and

$$\begin{aligned} &\Bigg(\sum_{j \in [j_0, j^*)} n_j \, g(e^*_f(w), \tau) + \sum_{j \in [j^*, \bar{j}]} n_j \, g(e^*_d(w), \tau) \Bigg) - \\ &\Bigg(\sum_{j \in [j_0, j')} n_j \, g(e^*_f(w), \tau) + \sum_{j \in [j', \bar{j}]} n_j \, g(e^*_d(w), \tau) \Bigg), \end{aligned} \tag{14}$$

and w_j denotes the wage that solves $\max_w \{\pi(j, f, w, \tau)\}$. Both Equations (11) and (12) will be positive since the fee, k, will incentivize an inefficient matching of workers with jobs corresponding to inherent productivity levels on the interval $(\theta_{j'}, \theta_{j*})$.

In short, while fee, k will exert upward pressure on wages, w_j, profits and productivity will decrease. In addition, if the assumption that k will not incentivize any job destructions is relaxed, then it is possible that the welfare effects of the increase in wages will be dampened by job losses.

A quota, limiting the proportion of a firm's workforce that may be filled by TFWs will similarly exert downward pressure on the 'cut-off' factor productivity level θ_{j*}, and thus, the definition of the deadweight loss it would incur is analogous to Equations (15) and (16). Assuming no job destructions as a result of some quota, q, we may define the number of TFWs that a firm may hire, Q, as follows:

$$Q = q \cdot \sum_{j \in [j_0, \bar{j}]} n_j,$$

such that $q \in (0, 1)$. However, it is unlikely that a fee of k and a quota, q, would yeild the same 'cut-off' θ_{j*} for two reasons. The first and somewhat trivial reason is that this proposition is mathematically unlikely to hold, and the second, pertains to the possibility that the TFW-filled jobs under the quota may be more profitable than those subject to a fee of k. The inverse of this case is also possible, depending on a variety of factors such as the profitability of affected jobs, the number of jobs that a firm may optimally fill with TFWs

and the difference in profitability between worker types in jobs that are optimally filled by TFWs.[38]

While the magnitude of productivity losses and wage gains for domestic workers (assuming no job destructions) induced by fees or quotas on TFW hires are highly case-sensitive, both will invariably incur a non-zero deadweight loss. One can observe from the figure above that the deadweight loss resulting from a quota would not correspond to a single interval of the domain of θ_j. If it is once again assumed that there will be no job destructions, any profit-maximizing firm will prefer to replace TFWs—in response to the imposition of a quota, q—by filling a combination of the least profitable jobs and jobs with small differences in productivity between worker types with domestic workers. It is for this reason that Brochu, Gross, and Worswick (2020) suggest that a fee may yield a better outcome for low-wage domestic workers if there is a tendency for high-wage positions to be among the most profitable at a given firm.

7 Discussion

Although this paper does not include a data analysis of the effects of the presence of TFWs on the hiring behaviour in industries where firms often bear the cost of training, existing analyses of data on Canada's Temporary Foreign Worker Program (of which little is public domain) appear to support the conclusions of this model.

According to Statistics Canada, TFWs transitioned to permanent residency (PR) at a rate of approximately 23% (after two years) in 2020.[39] O'Donnell and Skuterud (2022) obtain a similar result (20%) for the same year which represents a 3-fold increase in this figure since 2006, driven by a large commensurate increase in TFWs with open work permits under the International Mobility Program (IMP). Put differently, this increase in the PR transition rate can be attributed to an increase in the proportion TFWs who presumably supply work effort with a higher wage elasticity.

Cardoso et al. (2023) find a negative correlation between the wages of low-wage Canadian workers and the presence of TFWs at the firms at which they are employed in all industries except agriculture. This is an interesting exception since agriculture consistently accounts for the one of largest proportions of total TFWs in Canada in a given year among the North American Industry Classification System (NAICS) categories,[40] and is also an industry in

38. This list is by no means exhaustive.

39. Yuqian Lu and Feng Hou, "Foreign Workers in Canada: Differences in the transition to permanent residency across work permit programs," *Statistics Canada*, last modified June 26, 2024, https://www150.statcan.gc.ca/n1/pub/36-28-0001/2024006/article/00001-eng.htm.

40. Yuqian Lu and Feng Hou, "Foreign workers in Canada: Changing composition and em-

which Canadian workers exhibit the weakest labour force attachment.[41] The static model presented in this paper would suggest that this situation could be the result of persistent low wages failing to incentivize relatively wage-sensitive Canadian workers to supply a sufficient amount of work effort. While Brochu, Gross, and Worswick (2020) emphasize that the mere presence of TFWs in an industry will reduce wage premia, it is also possible that the employment of only domestic workers would have become unsustainable for this industry given its seasonal nature and typically low profit margins.

8 Limitations

A dynamic model would ultimately be required in order to examine the relationship between the hiring of TFWs and seasonality in the agricultural industry. In a static model, there can be no return to retaining an individual trained worker over more than one contract since the model itself only lasts for a single period. Moreover, low-wage Canadian workers likely require year-round employment to support the cost of living, whereas most TFWs come to Canada from countries where the cost of living is comparatively low (Falconer 2020), which may render the hiring of TFWs particularly advantageous. In this context, it is possible that hiring TFWs would not only allow firms to save on costs associated with shirking or quitting, but also on training costs if TFWs can be retained between seasons at a lower cost than domestic workers, once trained.

Another important limitation of the model presented in this paper is the definition of worker preferences. This is a notable divergence from the approach of Brochu, Gross, and Worswick (2020) who define work effort as a function that is increasing and concave in wages, and decreasing in a worker's outside offer (the next-best wage that a worker could be earning at a different firm), without specifying the preferences from which a worker's effort function may be derived. Although it is obviously possible to define a utility function that will yield a work effort function (a best-response to some wage offer, w) with the same properties, such a utility function would necessarily be decreasing in the value of a worker's outside offer (say u) if it were to enter into the the positive left-hand term of $U(e, w)$.[42] This would imply that a worker's utility is decreasing in a forgone consumption bundle, $c = e \cdot u$, which would violate the property of monotoncity that is typically assumed of individual preferences. To avoid

ployment incidences of work permit holders," *Statistics Canada*, last modified October 25, 2023, https://www150.statcan.gc.ca/n1/pub/36-28-0001/2023010/article/00004-eng.htm.

41. Yuqian Lu and Garnett Picot, "Foreign workers in Canada: Labour force attachment among temporary residents with paid employment in 2019," *Statistics Canada*, last modified March 27, 2024, https://www150.statcan.gc.ca/n1/pub/36-28-0001/2024003/article/00005-eng.htm.

42. See "The Basic Model" section.

this issue, it is merely assumed that there exist exogenous differences in the respective wage elasticities of domestic workers and TFWs, however, one could alternatively define wage rigidity, $\eta^{-1} = \delta(u_h)$, such that $\delta'(u_h) < 0$. In a wage-efficiency context, this formulation would imply that all workers have the same risk preferences, given by $\delta(\cdot)$, and the utility cost of losing a job that pays wage w is decreasing in outside offer u_h.

9 Conclusion

The exact role that TFWs ought to play in the Canadian labour market remains an elusive concept. While there is a strong consensus in support of the view that TFWs ought to occupy a lesser role than they do at present, this analysis shows that there may exist important industries that rely on low-wage labour that firms can train in a cost-effective manner. It is likely that Canada will need to rely on seasonal labour that cannot support the cost of living due to its high prevalence of low-margin seasonal industries. Conversely, the hiring of TFWs could drive increasing reliance on relatively cheap foreign labour through the reduction of wage premia (Brochu, Gross, and Worswick 2020), which is particularly concerning in light of ethical concerns and the TFWP's bad reputation.

To further complicate matters, the Temporary Foreign Worker Program and the International Mobility Program have experienced an ebb and flow of regulatory changes for the purpose of assuaging business owners and avoiding public scrutiny. This has not only had the effect of rendering these programs less reliable, but has also perpetuated misunderstandings about their effects on the labour market. As O'Donnell and Skuterud (2022) write, "the first priority should be to determine the economic objectives that TFW entries are achieving in the first place." This analysis posits the mitigation of the hold-up problem in low-wage labour markets as a suitable objective.

10 Use of Generative AI and AI-assisted tools

During the preparation of my thesis, I used ChatGPT for creating graphs, taking derivatives and simplifying equations. After using this tool/service, I reviewed and edited the content as needed and take full responsibility for the content of my thesis.

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11 Appendix

11.1 Workers' Problem

The functional form of U is assumed to be the following:

$$U(e,w) = c - \rho \cdot \frac{e^{1+\delta_h}}{1+\delta_h}.$$

$$\max_{c,e}\{U(e,w)\}, \text{ subject to } c = e \cdot w.$$

The first order condition yields

$$w = \rho \cdot e^{\delta_h}.$$

Isolating e from the above expression yields

$$e^*(w) = \left(\frac{w}{\rho}\right)^{\frac{1}{\delta_h}},$$

11.2 Firm's Problem, Perfect Information, without Training

$$\max_w \left\{\alpha_j \cdot \left(\left(\frac{w}{\rho}\right)^{\eta_h}\right)^{\phi} - \left(\frac{w}{\rho}\right)^{\eta_h} \cdot w\right\}.$$

The first order condition for this problem is given by

$$\alpha_j \cdot \phi \cdot \frac{\eta_h}{w} \cdot \left(\frac{w}{\rho}\right)^{\eta_h \cdot \phi} - \left(\frac{w}{\rho}\right)^{\eta_h}(1+\eta_h) = 0.$$

Rearranging this equation and isolating for w yields

$$w_h^* = \left(\alpha_j \cdot \phi\left(\frac{\eta_h}{1+\eta_h}\right)\right)^{\frac{1}{\psi}} \rho^{\frac{\psi-1}{\psi}},$$

where

$$\psi = 1 + \eta_h(1-\phi).$$

11.3 Proof of Proposition 1

The domain of w, $\mathbb{R}_+$, is a convex set, by definition.

Recall that for all $h = \{d, f\}$,

$$\pi(j, h, w) = \alpha_j \cdot \left(\left(\frac{w}{\rho} \right)^{\eta_h} \right)^{\phi} - \left(\frac{w}{\rho} \right)^{\eta_h} \cdot w,$$

and

$$e_h^* = \left(\frac{w}{\rho} \right)^{\eta_h}.$$

Thus,

$$\lim_{w \to 0^+} \pi(j, h, w) = 0,$$

and

$$\lim_{w \to \infty} \pi(j, h, w) \to -\infty.$$

Also note that

$$\frac{\partial \, \pi(j, h, w)}{w} = \frac{\alpha_j \cdot \eta_h \cdot \phi (e_h^*)^{\phi}}{w} - e_h^*(1 + \eta_h),$$

and

$$\begin{aligned} \frac{\partial^2 \, \pi(j, h, w)}{w^2} &= \frac{\alpha_j \cdot \eta_h \cdot \phi}{w^2} (\eta_h \cdot \phi (e_h^*)^{\phi} - e_h^*) - \frac{\eta_h \cdot e_h^*(1 + \eta_h)}{w} \\ &= \frac{\eta_h \cdot e_h^*}{w} \left(\frac{\alpha_j \cdot \phi}{w} (\eta_h \cdot \phi (e_h^*)^{\phi - 1} - 1) - (1 + \eta_h) \right) < 0, \end{aligned}$$

since $\eta_h, \phi < 1$.

Since $P(w) \in (0, 1)$ by definition, it follows that Π_j is a convex combination of the functions $\pi(j, d, w)$ and $\pi(j, f, w)$; that is

$$\Pi_j = P(w) \, \pi(j, d, w) + (1 - P(w)) \, \pi(j, f, w),$$

by Equation (3).[43] ■

11.4 Firm's Problem, Perfect Information, with Firm-Sponsored Training

$$\max_{\tau,w} \left\{ \beta \cdot (\tau_0 + \tau)^{\theta} \cdot (e_h^*)^{\phi} - e_h^* \cdot w - \overline{w} \cdot \tau \right\}, \text{ subject to } \theta, \phi \in (0,1),$$

and where

$$e_h^* = \left(\frac{w}{\rho} \right)^{\eta_h}.$$

The first order conditions yield

$$\beta \cdot \theta \cdot (\tau_0 + \tau)^{\theta - 1} \cdot (e_h^*)^{\phi} - \overline{w} = 0,$$

and

$$\beta \cdot (\tau_0 + \tau)^{\theta} \cdot \phi \cdot (e_h^*)^{\phi - 1} \cdot \frac{\partial\, e_h^*}{\partial\, w} - \left(w \cdot \frac{\partial\, e_h^*}{\partial\, w} + e_h^* \right) = 0,$$

where

$$\frac{\partial\, e_h^*}{\partial\, w} = \frac{e_h^*}{w \cdot \delta_h}.$$

Combining the above first-order conditions, and isolating training, τ, we obtain

$$\tau_h = w^{1+\eta_h} \rho^{-\eta_h} \left(\frac{\theta}{\phi \cdot \overline{w}} \right) \left(1 + \frac{1}{\eta_h} \right) - \tau_0.$$

43. Moreover, if we retain Brochu, Gross, and Worswick's (2020) assumption that $P(w)$ is increasing and concave in w, then the concavity of $\pi(j, h, w)$ in w implies that Π_j is concave in w by definition.