A model of the multiemployer pension system –DRAFT

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July 24, 2015

ABSTRACT

I develop a simple theoretical model of the Pension Benefit Guaranty Corporation's (PBGC) financially troubled multiemployer program to better understand its current challenges and help craft solutions. I use a monopolistic competition framework, as first developed by (Dixit & Stiliglitz, 1977) with soft barriers to entry to capture behavior in the ME system. The model identifies the trade-offs and limitations facing policy choices in responding to the multiemployer program's financial troubles. It shows how policy changes impact the potential for mass withdrawal events. It also describes the conditions under which a plan has exhausted all feasible measures to restore its plan to solvency, and develops a framework for thinking about what level of benefit reductions might place a company on a more sustainable footing. I draw a number of conclusions from the model: (1) the thresholds at which higher contributions are likely to trigger mass withdrawal will vary heavily by industry. (2) The system for remedying underfunding is fundamentally inefficient because it relies on a per participant charge that distorts economic decisions similar to a tax. (3) The impact of recent premium increases on company behavior is likely to be very modest because they represent a very small fraction of total plan costs.

I. Introduction

This study develops a simple theoretical model of the Pension Benefit Guaranty Corporation's (PBGC) financially troubled multiemployer program to better understand its current challenges and help craft solutions. The multiemployer (ME) program insures plans associated with unions where employees can earn credit for a common pension plan while working for different companies operating in the same industry. Contributions and benefits of the plan are set by a trustee and subject to collective bargaining agreements with the sponsoring union. The ME program has been in deep financial trouble lately because of insufficient plan funding, very low PBGC premiums that do not cover the risk of loss, and a decline in the rate of union membership in industries participating in multiemployer plans.

The model developed in this paper identifies the trade-offs and limitations facing policy choices in responding to the multiemployer program's financial troubles. It shows for example why raising premiums lowers the threshold for a mass withdrawal from ME pension plans and how changing withdrawal liability impacts the potential for mass withdrawal events. It also describes the conditions under which a plan has exhausted all feasible measures to restore its plan to solvency, and develops a framework for thinking about what level of benefit reductions might place a company on a more sustainable footing.

As a whole, multiemployer plans are deeply underfunded. In 2012, multiemployer plan assets equaled $392 billion compared to $964 billion in liabilities, according to the PBGC. One and a half million employees are covered by severely underfunded plans, with assets less than 40 percent of liabilities. Premiums in the multiemployer system have not fully reflected the risks of pension default. The PBGC's insurance system has enough money to cover its cash benefit promises over the next several years. However its net present value is severely negative, despite recent reforms. Before the passage of the Multiemployer Pension Reform Act in 2014, the PBGC the net present value deficit was over $42 billion, and projected to rise, according to (Pension Benefit Guarantee Corporation, 2014). The PBGC's most recent projections, which incorporate an estimated impact of the reform, project the net present value deficit at Y billion.

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While there is no statutory Federal guarantee of PBGC obligations, there would be intense political pressure for a bailout if PBGC became insolvent. The maximum guarantee for an employee with 30 years of service is less than $13,000, and approximately half of participants in failing plans can expect to see their benefits reduced when the PBGC takes over a plan. If the multiemployer trust fund runs out of money, beneficiaries of its insurance would lose over ninety percent of those already low guaranteed benefits.

The effectiveness of any reform to the pension system depends heavily on decisions employers and unions make. For the multiemployer program, participating companies face complex strategic decisions because of the joint nature of their liability, and the sensitivity of their own liabilities to the decisions of the other co-sponsors. Under certain circumstances, these dependencies can produce a rush to the door in multiemployer plans, where each withdrawal increases the liability of the remaining sponsors, and raises their incentive to exit themselves. Such a mass withdrawal leaves the underfunded plan without any source of income and destines it to run out of money and require assistance from the PBGC.

Recent legislation starting with the Pension Protection Act of 2006 and culminating with the Multiemployer Pension Reform Act of 2014, gave the PBGC and plan trustees new tools to address underfunding, but left open questions about how those tools might be used. The Pension Protection Act of 2006 tightened the funding requirements for multiemployer plans, but with an escape clause. It developed a system of designations for plans based on their funding status. Heavily underfunded plans in the “red zone” were required to present restoration plans that returned them to full funding over ten years. But MPRA allowed plan trustees to forgo contribution increases if they “exhausted all reasonable measures” to restore plan funding. Plan trustees have used that flexibility extensively since passage of the PPA, arguing that contribution increases might be counter productive because they could trigger mass withdrawal from their pension plan. When plans exhaust all reasonable measures to remedy underfunding they face a high likelihood of eventually running out of money, and turning to the PBGC for financial assistance, which covers benefits up to limits that result in benefit cuts to many participants. To help save plans from this fate Congress enacted the Multiemployer Pension Reform Act of 2014 as part of the annual appropriations bill, which supplied plan trustees with tools to reduce benefits to a sustainable level through benefit reductions and partitions, while exempting the most vulnerable groups from benefit reductions. The Department of the Treasury and the Pension Benefit Guaranty Corporation have proposed regulations to govern use of these authorities and Treasury appointed a special master to review applications for benefit reductions.

This study will supply a framework for analyzing when a plan can make a valid claim it has exhausted all reasonable measures, and in that case what benefit reductions are necessary to reduce underfunding to a level it can manage with contribution requirements. It finds that thresholds at which higher contributions are likely to trigger mass withdrawal will vary heavily by industry, and are sensitive to policy parameters such as the premium rate and the guarantee level. It finds that the impact of premiums on participation in the ME system is dollar for dollar equal to contributions. A dollar more premium is the same for sponsors as a dollar more contributions. One can thus gauge the impact of premium increases on company decisions by measuring them as a fraction of existing contributions.

II. The structure and functioning of the multiemployer pension system[1]

The Pension Benefit Guaranty Corporation (PBGC) insures two pension systems, the single employer system where workers earn benefits with a single company and the multiemployer system. In both systems workers earn benefits payments that are subject to a formula, for example supplying them in retirements with a benefit based on their average salary and years of service. Employers contribute to a pension fund held in trust for the pension plan beneficiaries and whose benefits are insured by the PBGC.

In contrast to single employer pension plans, which are associated with a single company, multiemployer pension plans are associated with a union. Workers participating in a multiemployer pension plan can earn benefits while working at different companies that have bargaining agreements with their union. This structure is especially beneficial for workers who frequently change employers in the same industry. Around ten million workers and retirees receive benefits from multiemployer pensions. Multiemployer pension plans are relatively prevalent in certain industries. Construction accounts for over half of multiemployer plans and one third of its participants, and the transportation industry also features a high rate of participation in ME plans.

While by no means representative, professional sports leagues supply an example of where multiemployer pension seem ideal. For a Major League baseball player traded from the Atlanta Braves

[1] For a more thorough description see (Pension Benefit Guarantee Corporation, 2013)

to the Washington Nationals, the multiemployer pension plan negotiated between the owners and the Players Association allows a seamless continuation of that player's pension benefits. The player continues to earn benefits according to the exact same formula as one team picks up the contributions where the other left off. This structure at its best combines the portability of defined contribution plans (although limited to an industry) with the certain benefits of the single employer defined benefit system.

Trustees determine the menu of benefits and contributions that participating employers can choose to offer their workers. Unions and employers each name half of the trustees of the plan. Trustees rely on actuaries to supply estimates of how much funding is sufficient to cover promised benefits, and determine whether a funding gap exists. When the present value of a plan's benefits (its liabilities) exceeds its assets, trustees set contributions at a level that can remedy part of that underfunding as well as fund any new benefits. If a company wishes to withdraw from a multiemployer pension plan while it is underfunded, trustees assess a withdrawal liability which represents the company's share of the underfunding. The company must pay for that underfunding after it withdraws in a series of annual payments capped at its recent contribution level over twenty five years. Because of the cap, and the possibility that the withdrawn company might go bankrupt sometime in the twenty-five year period the expected present value of the payments can often be lower than the present value of the benefits it means to cover. As a result healthy employers have an incentive to withdraw from underfunded plans and each withdrawal of an employer increases the burden on the remaining employers. That increased burden raises the likelihood that they too will leave, giving rise to the phenomenon of mass withdrawal.

In a thriving unionized industry (like the sports leagues), the plan can survive even if individual companies go out of business or withdraw. The remaining companies become responsible for the underfunding that the departed company no longer will cover. But in recent years unions offering multiemployer pension have seen their active membership decline, with a shrinking number of employers and employees.

III. Existing Literature

An almost complete lack of analytical models of the program makes it hard to craft solutions to the ME program's problems. A number of analysts have written about the multiemployer program, in some cases calling it the forgotten program compared to the better-studied single employer pension system. But to my awareness the only attempts to model the program in any way have been by the government

agencies responsible for projecting the PBGC's finances, including the PBGC itself. The PBGC recently developed the multiemployer version of their pension insurance modeling system (ME-PIMS). That model, described in (Pension Benefit Guarantee Corporation, 2012) simulates the performance of the ME program under different economic scenarios but has little to say about how strategic decisions might change in reaction to policy changes. It estimates mass withdrawals from the multiemployer program using a statistical hazard model identifying how the conditions and thresholds that are associated with mass withdrawal apply under current policy, but do not say how those thresholds might change if the rules change.

PIMS models mass withdrawal using an approach that links industry and plan characteristics to the probability of mass withdrawals. The parameters used in PIMS are valid under the policies that have been in effect throughout history, but not under policy changes, because they are estimated from a sample of data characterized by past not proposed policies. The PBGC recently has recognized this limitation of PIMS in response to a report from (Buck Consultants, 2012). They concluded that PIMS' statistical parameters do not adequately capture behavior in the Multiemployer Program following the Pension Protection Act (PPA) of 2006, because the parameters were estimated from a sample in which the period before the PPA predominates. They have made adjustments to the parameters to correct for this problem. However for the same reason the parameters governing plan behavior were not valid for the post-PPA period, they would be invalid for evaluating proposed policies that substantially change the incentives behind mass withdrawal.

For example, suppose a reform made the present value of withdrawal liability payments higher rather than lower than the present value of contributions a company would face if it stays. Then there would be a financial penalty rather than a benefit to leaving. Under such a policy, mass withdrawals are unlikely to occur anymore; the dynamic under which one plan's departure creates more incentive for other plans to leave would be short circuited. Each plan's departure in fact would increase the incentive for the remaining plans to stay, because the penalty paid by the withdrawing company would lessen the burden on the remaining companies participating in the plan.

PIMS would not capture the impact of this change in incentives on the likelihood of withdrawals, nor would it change the estimated conditions under which a mass withdrawal takes place. Withdrawals would not be estimated as less likely to take place under this reform, even though it might completely eliminate the phenomenon of mass withdrawals. But a model that coherently incorporates the

incentives on decisions of individual employers could conclude that mass withdrawals are much less likely under this proposed policy.

Even much simpler reforms like premium increases might have impacts on mass withdrawals that PIMS would fail to capture. Premiums in the multiemployer program are very low, and it is worthwhile to consider raising them to cover the PBGC's increasing burden in this program. However, a substantial premium increase could push an employer close to the edge of leaving a plan to actually leave. The cost of staying could exceed the cost of leaving once the premiums rise. A premium increase could therefore encourage one employer to leave a plan, and without reforms to withdrawal liability, that could trigger an exit of the remaining companies. The impact of premium increases on withdrawal would not be captured by PIMS because it would continue to judge the likelihood of withdrawal based on parameters estimated statistically using data from a policy regime where the premium increase had not yet taken place. A model that explicitly models the incentive to withdraw and conditions projected behavior on those incentives could capture the degree to which the premium increases leads to a higher likelihood of withdrawals including mass withdrawals.

IV. Model Structure

I use a monopolistic competition framework, as first developed by (Dixit & Stiliglitz, 1977) with soft barriers to entry as the framework best able to capture behavior in the ME system. I also assume that plan benefits have some value beyond other forms of compensation for the participating workers. Under the monopolistic competition framework, employers face competition but do have some franchise value despite the competition. Employers in ME plans are able to survive with the competitive disadvantage of a slightly underfunded plan for some time and to some degree. When that disadvantage becomes too great, however, employers in ME plans can no longer sustain their participation in the plan. A model with perfect competition would have plans collapsing at the first instance of underfunding, in contrast, and would never be able to explain why an employer would be willing to make a withdrawal payment and remain in business. Nevertheless, a perfectly competitive industry is a special case of the model presented in this study, and we can trace out its implications by setting the parameters to the corresponding levels.

There are a few dynamics in the multiemployer system that I do not attempt to capture in this first attempt. For analytical convenience this model assumes that companies in an industry are

homogeneous and equally sized. In reality, companies sponsoring a single pension plan can vary in size and creditworthiness, and those variations give rise to strategic considerations among the companies. In particular the financially stronger employers sponsoring an underfunded plan can have an additional incentive to withdraw if they believe that the other employers are likely to fail before fulfilling their share of the responsibility for the underfunding. For example the United Parcel Service (UPS) previously participated in the Teamsters plan, where it was the largest and most valuable franchise. The UPS withdrew from the Teamsters plan in 2007, perhaps recognizing that it was likely to have to foot the bill for less creditworthy plans as they failed and did not meet their responsibilities to the plan. The withdrawal of UPS, the largest contributor, complicated the situation facing the Teamsters plan.

I do not attempt to model as situation like that of UPS and the Teamsters. Aside from capturing the relative fragility of plans with one large relatively creditworthy sponsor, it is not clear what insights might be gleaned from modeling the heterogeneity of plan employers. Furthermore, modeling heterogeneity would ultimately be of little use when it comes time to estimate or validate this model with empirical data, as I would like to do in future research. Information filings on ME pension plans supply data only at the plan level, and neither identify nor supply data on the contributing employers.

In addition, this model does not attempt to explicitly model the process of bargaining over ME plans between employers and unions. As noted earlier while trustees set benefit and contribution levels, those levels need to be incorporated into collective bargaining agreements, which are negotiated between labor and management along with numerous other aspects of employee compensation, working conditions, and contracts. I do not model unions and collective bargaining agreements in this study, because doing so would have added significantly to the complexity with unclear payoffs in terms of understanding the dynamics of ME plans. I assume that labor markets are competitive in the model. The reason why explicitly modeling unions and collective modeling might not change results by much, is that once trustees set benefit levels and contributions, the main decision facing a company and its workers is whether or not to continue participating actively in the plan -the decision whether or not to withdraw. Companies must make withdrawal payments when leaving a plan, and also might face opposition from their unions, which can threaten to strike, as the Teamsters did upon UPS's first attempt to withdraw in 1997. I explicitly model the withdrawal payment, but not the cost imposed by the union, but one can think of the explicit withdrawal charge parameter as also representing the cost imposed by the union in the bargaining process. If for example a company needs to make a statutory

withdrawal payment to the plan but also make a concession to the union to get out of the plan, then the full cost of withdrawal can be seen as the sum of the value of those two elements.

This study uses a one period framework to try to capture the key features of the program and the key incentives facing different actors. It results in some findings that are fairly consistent with intuition and highlight the potential unintended consequences of policy choices intended to shore up the program. But the use of a single period requires some strong simplifying assumptions that limit the value of the model, and future research should try to extend it into a multi period framework. One strategy for extending the model into a multi period framework would be to use a state-space framework, designating certain variables as summarizing the current state of the system.

I capture the cost of PBGC premiums and the benefit of PBGC guarantees to the plans in the model. I model premiums as a required payment by participating companies, and guarantees as augmenting the benefits actually received by plan participants in cases where the plan is underfunded.

The model applies a one-period framework where companies participating in a multiemployer plan compete with non-plan companies in labor and product markets. The model has the following stages:

1. **Trustees** set benefit levels of and contribution requirements.

2. **Existing companies** decide whether not to continue in business and if so, whether or not to continue in the pension plan, paying withdrawal liability if they do not.

3. **New companies** decide whether or not to enter the market, and if so, whether or not to participate in the pension plan.

4. **Hiring stage**: Companies hire workers by promising them a mix of ME plan benefits, if they participate in the plan, and cash compensation.

5. **Production / Consumption:** Companies produce goods, sell them to consumers, pay workers, distribute profits, make contributions to the pension plan, and pay pension premiums and penalties associated with contribution requirements. Benefits including those funded by PBGC are distributed to individuals.

To solve this model we use recursion, working from the final stage backwards. First we solve for a function that describes production and consumptions decisions in stage 5 under parameters that reflect

decisions that took place in the prior four stages. Then for stage 4 we incorporate the functions generated by solving stage 5 into expressions that describe the benefit and wage packages offered to employees hired by companies participating in multiemployer plans and their non-plan competitors. A key ratio in the model will be the ratio in variable cost per unit of labor of workers participating in pension plan to non-plan. In stage 3, depending on this relative cost, potential new entrants decide whether they wish to pay the fixed costs of entering the industry, and those that enter decide whether or not to participate in the multiemployer pension plans. Under the standard assumption of monopolistic competition, new companies continue to enter the industry until the economic profits of a new entrant are driven to zero (or in other words their accounting profits exactly equal their opportunity cost). Incumbent firms can potentially still make profits at that point because they do not face as high a fixed cost as the new companies.

The higher the ME plan-to-non-plan cost ratio, the more new entrants, the less market share left for existing companies, who were assumed to all participate in the plan at the outset. When there is too little market share left for them to make a profit, they can decide not to participate in the market, or in other words drop out of business. Incumbent companies can also decide to withdraw from the plan at which point they achieve the same per unit labor cost as new entrants, but they face a withdrawal liability payment. They will withdraw when the additional variable profits they can make as a non-plan company exceed the fixed cost of withdrawing in the withdrawal payments.

Trustees in stage 1 anticipate how stages 2-5 will play out based on their decisions about benefit and contribution levels, but they face constraints in the funding rules governing pension plans. In particular they need to set contribution rates at such a level to remedy part of the underfunding that preexists.

a. Utility

Worker utility is the sum of two components:

$$U = \left(\sum_i x_i^{\rho}\right)^{\frac{1}{\rho}} + b^{\theta} \qquad (1.)$$

Where $0 < \rho < 1$, $0 < \theta < 1$, i represents a variety of the consumption good

The first term $\left(\sum_i x_i^{\rho}\right)^{\frac{1}{\rho}}$ is standard in Dixit-Stiglitz monopolistic competition models, and captures the utility associated with consumption of the available varieties of goods. The second term b^{θ} represents the utility associated with the consumer's multiemployer retirement benefits. The concave nature of the function b^{θ}, where $0 < \theta < 1$, captures the notion that multiemployer retirement benefits have value over and above cash at the first dollar but face diminishing marginal utility. This structure to the utility function leads to a solution where receiving a finite fraction of their compensation in multiemployer benefits make workers better off if they received cash equal to the cost to their employer of those benefits. This additional utility makes it advantageous to employers to offer multiemployer benefits in a situation when they do not face additional costs to remedy the underfunding of past benefit promises. The additional utility that consumers receive represents the unique benefits of multiemployer plans which gave rise to their existence in the first place. As described earlier, multiemployer plans give workers a definite benefit, not subject directly to the volatility of investment returns, which they can earn without being tied to a single employer. Also multiemployer pension funds enjoy a tax shelter, as their investment earnings are not subject to taxation.

The Dixit-Stiglitz term $\left(\sum_i x_i^{\rho}\right)^{\frac{1}{\rho}}$ is identical to the one used in commonly-used monopolistic competition models and leads to several convenient results. Under that specification marginal utility is constant with respect to total expenditure, because of the combination of the exponent ρ inside the parentheses and $\frac{1}{\rho}$outside. Utility increases with the variety of goods available, because $0 < \rho < 1$. As I will show later, consumers maximize utility buying a basket of all available varieties of the good, with the proportions depending on their price. Under the demand curves created by those consumers firms maximize profits by charging a fixed markup over marginal cost.

b. Production

Each firm produces and has a monopoly in a variety of the good denoted i. Firms face a linear cost function. To produce x_i units of variety i, firm i must hire A units of labor to start of production and then an additional k units of labor for every unit of x_i it produces. The following equation governs the demand for labor for each company:

$$L_i = \begin{cases} A_{ME} + kx_i & \text{for incumbent companies in ME plan} \\ A_N + kx_i & \text{for new entrant companies} \end{cases} \qquad (2.)$$

A_{ME} is the fixed cost of incumbent multiemployer plans, and A_N the fixed cost of non-ME plans with $A_{ME} < A_N$.

The industry once was exclusively dominated by companies participating in a multiemployer plan which now face competition from new entrants that do not bear the legacy costs of the plan. The incumbents have some protection from this competition. First, they control access to the multiemployer plan, which as noted earlier can supply utility over and above what is possible with cash wages of equal cost. Second because they already participate in the industry, I assume that they might face a lower fixed cost of production relative to non-ME new entrants. The gap between $A_N$and A_{ME} can also represent the cost of overcoming union resistance to starting a company in the same industry with non-union labor and/or not participating in the multiemployer plan. I make these assumptions to reflect the apparent reality, that multiemployer plan companies seem to have some franchise value and do not wilt at the first instance of competition with lower variable costs, and that unions might have some tools at their disposal to block withdrawal. In the real world, this franchise value, and the barriers to competition, might depend heavily on the nature of the industry. So we can think of the model as capturing a particular industry, and the parameters of the model as varying by industry. Sports leagues, of course have significant barriers to competition and we observe healthy multiemployer plans there. You might think of them as a case where $A_N = \infty$.

c. Benefits

The utility of the worker will depend on their expectation of actual benefits paid b, as opposed to promised benefits $\tilde{b}$ based on the following expression.

$$b = \tilde{b}\left(\frac{V}{B} + \frac{B-V}{B}G\right) \qquad (3.)$$

The actual benefits paid to the worker b will depend on how much the plan can make good on what was promised as well as what the PBGC guarantee will cover of the unfunded benefits. The ratio V/B represents the fraction of benefits that are funded. And $\frac{B-V}{B}$ represents the unfunded portion of benefits, of which workers will only receive the guaranteed portion G. This specification of the PBGC guarantee is a very simplified version of what happens in reality. The PBGC guarantees partial payments up to a certain maximum that depends on a worker's years of service under the plan. Despite being simple, this representation of the PBGC insurance conveys the basic notion that the value of benefits,

and thus the reduction in cash wages workers are willing to bear in exchange, depends on the extent of the guarantee.

d. Total Cost of Compensation

We will represent the cost per unit of labor in the multiemployer plan companies as ω, and use the unit cost of labor in non-ME plans as the numeraire, in other words setting the per unit wage of non-ME workers to one. The parameter ω thus is the ratio of total labor compensation costs in ME companies to non-ME companies. ω will equal the wages paid per unit of labor to ME workers, plus the contributions and premiums paid per unit of labor.

$$\omega = w_{ME} + c + \tau \qquad (4.)$$

where c is the contribution per unit of labor, and τ is the rate of premiums per unit of labor.

The cash wages received by ME workers will be lower than the wages received by non-ME workers because they receive pension benefits. In the competitive labor market companies participating in the ME plan will be able to attract workers by offering cash wages that are lower by an amount that exactly compensates for the value of the expected pension benefits. The value of the expected pension benefits will depend, in turn on what is promised, what is funded and what is guaranteed by the PBGC.

e. Consumption and Pricing

In the last stage of the model, producers produce and price products and consumers choose how much to buy of each variety. Under the demand curves associated with the Dixit-Stiglitz preferences of the model, the profit maximizing price is a fixed markup, related to the parameter ρ, over variable cost. The variable costs of all varieties of goods produced in ME plans are $k * \Omega_{ME}$ and non-ME varieties $k * \Omega_N$. The prices of those goods are $\frac{k\omega}{\rho}$ and $\frac{k}{\rho}$ respectively. Consumers will allocate their purchases between varieties such that:

$$\frac{q_i}{q_j} = \left(\frac{p_i}{p_j}\right)^{\frac{1}{\rho-1}} \qquad (5.)$$

leading the ratio of units purchased of each ME good to units purchased of each non-ME goods to be:

$$\frac{q_{ME}}{q_N} = \omega^{\frac{1}{\rho-1}}, \tag{6.}$$

Based on (6.) the following is the ratio of total revenue spend on a ME-good variety to non-ME good variety:

$$p_{ME}q_{ME} = \omega^{\frac{\rho}{\rho-1}} p_N q_N \tag{7.}$$

Note that because $0 < \rho < 1$, the exponent $\frac{1}{\rho-1}$ is negative, a higher relative labor cost in ME companies leads to lower relative expenditure in each variety of ME goods, as one would expect.

One feature of Dixit-Stiglitz preferences is that utility is linear in the consumer's expenditure. For each dollar of expenditure $\frac{1}{\mathrm{N_N}+\mathrm{N_{ME}}\left(\frac{\omega_{\mathrm{ME}}}{\omega_{\mathrm{N}}}\right)^{\frac{\rho}{\rho-1}}} \frac{\rho}{\omega_{\mathrm{ME}}}$ units of each non-ME good will be purchased and

$\frac{\left(\frac{\omega_{\mathrm{ME}}}{\omega_{\mathrm{N}}}\right)^{\frac{\rho}{\rho-1}}}{\mathrm{N_N}+\mathrm{N_{ME}}\left(\frac{\omega_{\mathrm{ME}}}{\omega_{\mathrm{N}}}\right)^{\frac{\rho}{\rho-1}}} \frac{\rho}{\omega_{\mathrm{N}}}$ units of each ME-good will be purchased, generating $u(\omega, N_N, N_{ME})$ of utility, where

$$u(\omega, N_N, N_{ME}) = \left(\mathrm{N_{ME}} \left[\frac{\rho}{\omega_{\mathrm{ME}}\left(\mathrm{N_N}+\mathrm{N_{ME}}\left(\frac{\omega_{\mathrm{ME}}}{\omega_{\mathrm{N}}}\right)^{\frac{\rho}{\rho-1}}\right)} \right]^{\rho} + \mathrm{N_N} \left[\frac{\rho\left(\frac{\omega_{\mathrm{ME}}}{\omega_{\mathrm{N}}}\right)^{\frac{\rho}{\rho-1}}}{\mathrm{N_N}+\mathrm{N_{ME}}\left(\frac{\omega_{\mathrm{ME}}}{\omega_{\mathrm{N}}}\right)^{\frac{\rho}{\rho-1}}} \right]^{\rho} \right)^{\frac{1}{\rho}} \tag{8.}$$

f. Labor Market Competition

As non-ME workers earn one dollar for their one unit of labor, their utility will equal $u(\omega, N_N, N_{ME})$, which I will call just u. And because labor markets are competitive, workers in companies that participate in ME plans, will need to offer a combination of benefits and cash wages that achieves that same level of utility, such that:

$$w_{ME}u + b^{\theta} = u \tag{9.}$$

Or

$$w_{ME} = 1 + \frac{b^{\theta}}{u} \tag{10.}$$

Combined with (3.), this leads to the following formula for total compensation at ME firms:

$$\omega = 1 - \frac{1}{u}\left(\tilde{b}\left\{\frac{G\widetilde{B_1}+(1-G)V_1}{G\widetilde{B_1}}\right\}\right)^{\theta} + c + \tau \qquad (11.)$$

The total cost of compensation for workers in ME firms is the sum of cash wages, contributions and premiums. The ratio of total compensation in ME to non-ME plans goes up with contribution requirements and premiums, and goes down with funding levels, the size of benefit promises, the PBGC guarantee and the funding ratio of plans.

g. The decision to enter the market and join the ME-plan

It is possible for the total cost of compensation in ME plans to be lower than the cost of compensation in non-ME plans, which occurs if the value of the benefit to workers is greater than the value of additional costs:

$$\frac{1}{u}\left(\tilde{b}\left\{\frac{G\widetilde{B_1}+(1-G)V_1}{G\widetilde{B_1}}\right\}\right)^{\theta} \geq c + \tau \qquad (12.)$$

Under that condition workers will trade more in cash wages for pension benefits than it costs to supply them. It is a good deal to participate in the plan, for companies that have a choice, and new companies will participate. This condition would characterize the state of ME plans in their growth phase, where they are able to offer a unique benefit that attracts employers and workers, and unencumbered by the need to remedy underfunding.

The more relevant situation for the purposes of this study is where the condition does not hold and the total cost of compensation in ME plans exceeds the total cost in non-ME plans, representing the current state of much of the ME plan system. In that case, new entrants opt not to participate in the plan and create competition for those employers remaining in the plan.

The amount of competition depends on how many new companies enter the industry. Under the Dixit-Stiglitz framework, new companies will enter as long as their variable profits equal or exceed the fixed cost of entering the market. As new companies enter, the market share of all companies will shrink, and because profit margins are a constant fraction of variable cost under Dixit-Stiglitz preferences, variable profits shrink in proportion to market share. New companies will stop entering the market when market

shares have shrunk sufficiently for fixed costs to exactly equal variable profits, yielding the following relation:

$$\pi_N^V = A_N = p_N q_N(1-\rho) \tag{13.}$$

which implies: $\mathrm{p_N q_N} = \frac{\mathrm{A_N}}{(1-\rho)}$.

The variable profits of ME companies is a fixed fraction of total revenues for ME companies.

$$\pi_{ME}^V = (1-\rho)p_{ME}q_{ME} \tag{14.}$$

Using equation (7.) which relates ME market share to non-ME market share, this leads to the following expression for variable profits at ME companies.

$$\pi_{ME}^V = A_N \omega^{\frac{\rho}{\rho-1}} \tag{15.}$$

And given fixed costs of $A_{ME}\omega$, total profits are thus equal to:

$$\pi_{ME} = A_N \omega^{\frac{\rho}{\rho-1}} - A_{ME}\omega \tag{16.}$$

Two factors lead ME profits to differ from non-ME profits. First, their lower fixed costs tend to generate higher profits. For example an ME company with compensation costs exactly equal to non-ME companies ($\omega = 1$) will enjoy profits equal to the difference in fixed costs. However higher costs of compensation depress ME revenue and variable profits, offsetting this fixed cost advantage.

h. The decision to stay in business or withdraw

Companies in the ME plan considering whether to close their businesses or withdraw from the pension plan will base their decision on the variable profits they can enjoy as a multiemployer company, their fixed cost of operating, and the profits they might enjoy by withdrawing from the plan. If they withdraw from the plan they will enjoy variable profits equal those of a new entrant, with the lower fixed cost of an incumbent plan. But they will need to pay a withdrawal fee. The total profits of a withdrawn

company π_{-ME} will equal the difference in fixed costs minus the withdrawal fee, as given the in the following expression:

$$\pi_{-ME} = A_N - A_{ME} - W \tag{17.}$$

A company will choose to withdraw over staying in the plan if the profits associated with withdrawal are higher than the profits associated with staying the plan; if the following inequality holds:

$$A_N - A_{ME} - W > A_N \omega^{\frac{\rho}{\rho-1}} - A_{ME}\omega \tag{18.}$$

If the company cannot achieve positive profits from withdrawing or remaining in business in the multiemployer plan, then it will close, as would be the case when the following holds:

$$max\left(A_N - A_{ME} - W, A_N \omega^{\frac{\rho}{\rho-1}} - A_{ME}\omega\right) < 0 \tag{19.}$$

Under equations (18.) and (19.), withdrawal is more likely to be preferential to remaining in the plan the lower the withdrawal fee, the higher the ratio of compensation in ME plans to non-ME plans, the higher the fixed cost of entering the industry, and the higher the degree of substitutability of products. Going out of business is likely to be preferable to remaining in an ME plan the higher the ratio of compensation in ME plans to non-ME plans, the lower the fixed cost of entering the industry, and the higher the degree of substitutability of products.

Figure 1

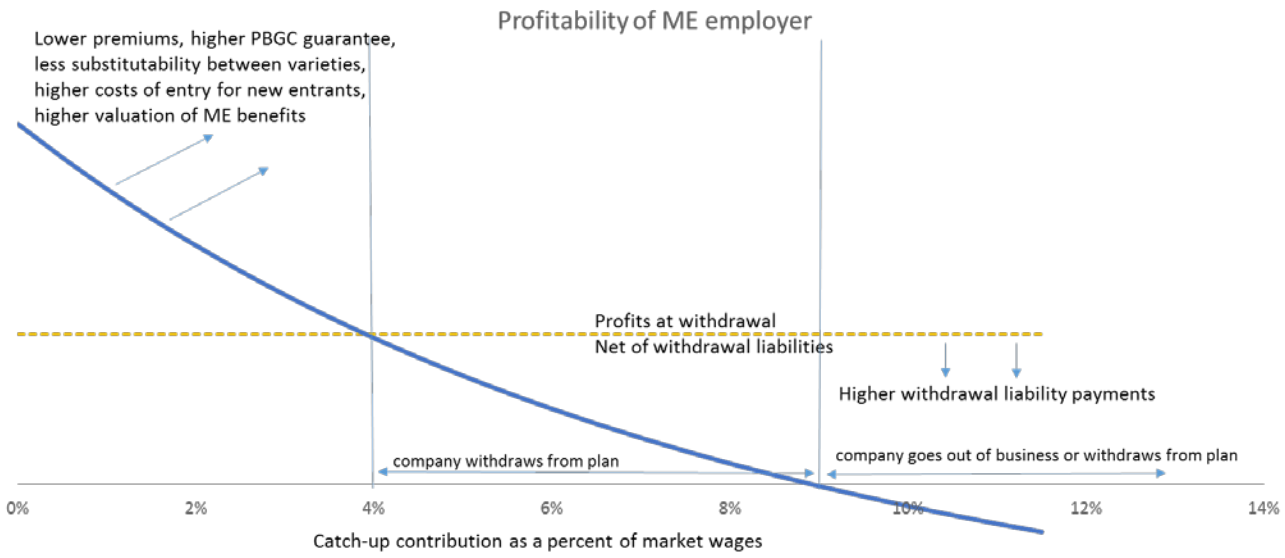


Figure 1 summarizes the implication of equations (18.) and (19.). It shows that more substitutability, or lesser differentiation, of products makes it more likely that ME employers will either go out of business or withdraw from the plan. That relation comes from the fact that less differentiation raises the impact of competition from non-ME firm varieties with a variable cost advantage over ME companies. That higher impact of competitions causes ME firms to be more likely to switch, whatever the withdrawal cost, or go out of business, if the withdrawal cost is too high.

Similarly a higher ratio of total cost of compensation in ME plans to non-ME plans makes it more likely that ME plans will do something to exit the plans, either going out of business or withdrawing. The higher that ratio the more difficult it is for ME-plans to generate a profit and the greater the advantage of non-ME companies, all else equal. Pension funding levels, contribution requirements, the PBGC premiums and guarantee, and parameters measuring the preferences towards ME benefits to workers all impact the decisions whether or not to withdraw or stay in business through their impact on the compensation ratio. Higher contributions or PBGC premiums raise the likelihood towards withdrawal or closure by raising the ratio. Higher funding levels, PBGC guarantees, and valuations of benefits raise the likelihood that ME companies will stay in the plan and in business, because they raise the amount of wages that workers will trade for their promised PBGC benefits.

A high fixed cost of entry makes it more likely companies will stay in business, but also more likely that they will withdraw from the pension plan. High fixed costs of entry reduce the competition from new companies and thus raise the profitability of existing companies both if they stay in business and if they

withdraw from the plan. By raising the market share of existing companies, they raise the volume of sales over which a company that withdraws from the plan could exploit its variable costs advantage, to recover the cost of the withdrawal fee. Because they raise the benefit of a lower variable cost for a firm that does not face the cost of entry, they make it more likely that firms will be willing to pay the withdrawal fee.

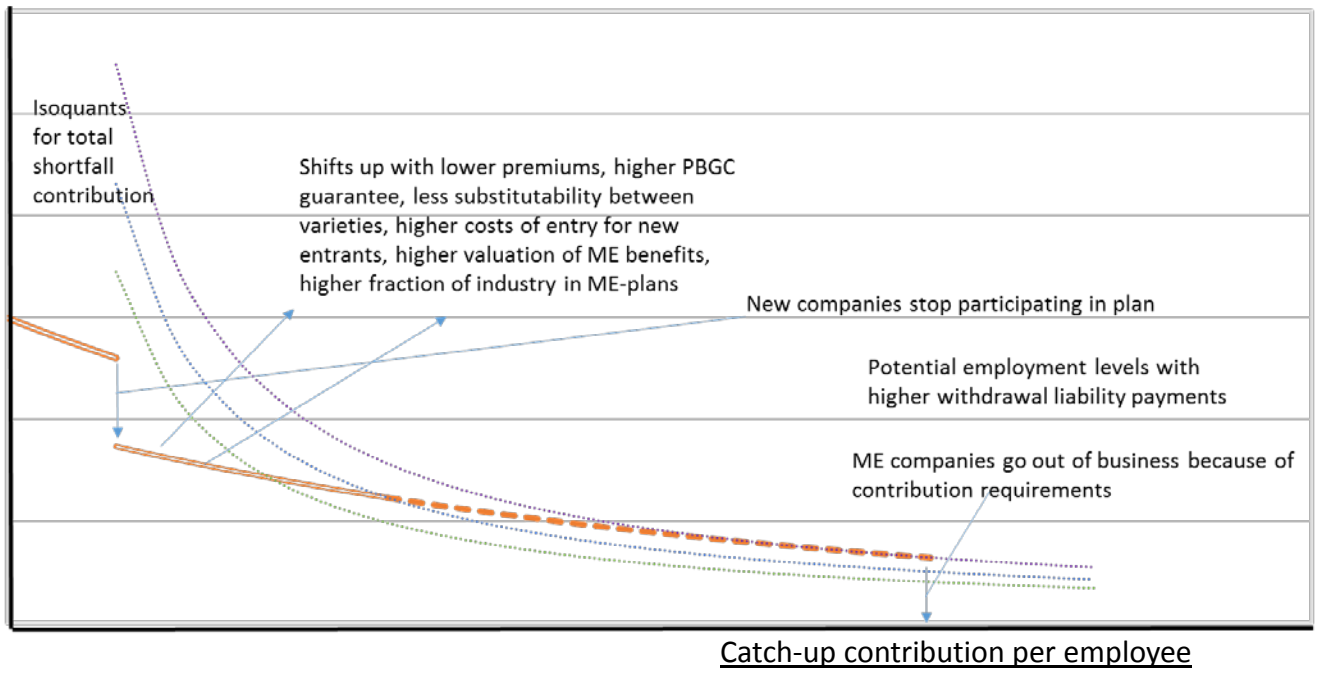
i. The Trustees decision, funding requirements, and exhaustion of all reasonable measures

Trustees will set contribution requirements and benefit levels with these sensitivities in mind, as they pursue the objectives of company profitability and plan security. Trustees also need to comply with minimum funding requirements when they set the menu for contribution and benefit levels. Under this model trustees will offer a single combination of benefit levels and contribution requirements (rather than a menu), because of the homogenous nature of firms participating in the plan. Depending on whose interests they actually serve, trustees might maximize benefit security subject to a constraint that ME-plans make positive profits (and do not mass withdraw) or they may maximize profits of ME-firms subject to minimum funding requirements.

Minimum funding requirements for underfunded plans will generally require that companies contribute an amount equal to the new benefit promises plus an amount that remedies part of the underfunding each year. The trustee's problem of setting benefits and contributions for an underfunded plan can be solved in two steps: first to find the optimal level given of new benefit promises funded with contributions; second to determine the level of contributions in excess of benefits $(c - b)$ that will maximize the amount of total underfunding the plan can reduce in the period. Let $L()$ be a function that measures employment in the ME companies given the optimal level of funded benefits, premiums, and other parameters of the model. The trustees want to maximize $L(c - b) * (c - b)$, the total amount of contributions that remedy underfunding, which is equal to employment in ME plans time the per-employee excess contribution. The trustees face a situation where increases in the excess contribution lower the market share of ME companies, because they raise their compensation cost and prices. $L(c - b)$ is directly related to the market share of ME companies and declines monotonically with the excess contribution.

As shown in equations (18.) and (19.), the company will withdraw from the plan or go out of business when the compensation ratio passes a threshold level, which occurs when excess contributions, $c - b$, pass a threshold level. Up to that threshold, $L(c - b)$ declines continuously, and at that threshold it falls abruptly to zero under the model. That is one of two discontinuous drops in the function $L(c - b)$. The other occurs at a low level of excess contribution. When contributions exactly equal benefits, new companies elect to join the ME plan because they can lower their compensation costs by taking advantage of workers' preference to receive benefits through the ME system.

Figure 2



The figure portrays the trustees' optimization problem in light of these results. It depicts how the function $L(c - b)$ monotonically decreases and drops at two thresholds. The figure assumes that the withdrawal payment will be set so that withdrawing yields positive profits at the threshold where it is no longer advantageous to continue in the ME plan. A solid line depicts the relationship $L(c - b)$ -the set of possible combinations of per-worker excess contributions, and total ME employment. The solid line stops at the withdrawal threshold. With much higher fees that preclude withdrawal, $L(c - b)$ would continue to be positive at levels of excess contribution until such point as plans go out of business. The dashed line depicts those levels of employment that would be possible with higher withdrawal fees.

The product of the ME plan employment and the excess contribution rate is the total excess contribution to the pension plan. The figure also include several isoquants each representing combinations of employment and the excess contribution rate that remedy a given total amount of underfunding. The isoquants to the top right represent more underfunding remedied than the isoquants to the bottom left.

The highest isoquant that touches the employment curve represents the maximum amount of underfunding that can be remedied under the rules and parameters governing the graph. That isoquant could touch the employment curve at the point of mass withdrawal, or at an interior point, where employment is declining, depending on the other parameters of the model. At the point where the contribution tips the system into mass withdrawal trustees theoretically face a question of whether more money could be raised through the withdrawal fees than through the contributions.

The following version of the figure yields insight into the situation facing trustees who have exhausted all reasonable measures to achieve the required degree of restoration. In this version a restoration plan that returns the plan to solvency requires total excess contributions at a level consistent with the isoquant labelled "plan," but that isoquant is to the top right of the possibilities curve.

V. Conclusions

One main conclusion from this study is that the thresholds at which higher contributions are likely to trigger mass withdrawal will vary heavily by industry. Industry characteristics, and in particular the nature of competition in an industry, have a large impact on the level of underfunding a multiemployer plan can remedy through increased contributions. Lower levels of substitution between different varieties in an industry allow a plan to sustain much higher contributions without a mass withdrawal. Barriers to entry to new entrants, for example in the form of fixed costs, also permit higher contributions. Even in industries with high degrees of specialization and high barriers to entry, the capacity for higher contributions is limited by size of the withdrawal liabilities. Companies can exit when the required contributions exceed the amount they would be required to pay upon withdrawal.

A second conclusion is that the current system remedies underfunding through a mechanism that has many of the same in efficiencies as a tax on income. Under the current system a company's contributions for remedying underfunding increase with its employment in the plan, and thus create a disincentive for higher plan employment relative to a system where sponsors were assessed liability as a lump sum. The per participant charge lowers employment in the ME companies below a socially optimal level because it raises marginal compensation costs above the marginal social costs of producing the goods. It induces companies to withdraw or not participate in multiemployer plans even when doing so could yield benefits to workers beyond what they would get from cash wages. It also reduces the

maximum amount of funding that companies are able to pay by placing them at a competitive disadvantage to their non-ME competition.

Finally, the model help put premium increases, of the kind passed in the MPRA, in proper perspective. Under the model in this paper all policies impact outcomes through the relative cost of compensation in companies sponsoring multiemployer plans. A dollar of premium revenue and a dollar contribution have the same impact on that relative cost. The recent doubling in PBGC per participant premiums, passed as part of MPRA, raised the multiemployer program's income by roughly $130 million per year, which as a fraction of the 40 billion dollars of annual contributions is a fraction of a percent of total plan costs.

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